BUREAU OF FISHERIES

REPORT OF

THE COMMISSIONER OF FISHERIES
FOR THE FISCAL YEAR 1907

AND

SPECIAL PAPERS

GEORGE M. BOWERS
Commissioner

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The distribution of fish and fish eggs during the fiscal year 1907. Document 630, 78 p. (Issued February 4, 1908.)

The fisheries of Alaska in 1907. By M. C. Marsh and J. N. Cobb. Document 632, 64 p. (Issued April 16, 1908.)

The fishes of the Connecticut Lakes and neighboring waters, with notes on the plankton environment. By W. C. Kendall and E. L. Goldsborough. Document 633, 77 p., pl. i–x, 2 charts, text fig. 1–5. (Issued July 6, 1908.)

Devils Lake, North Dakota: A study of physical and biological conditions with a view to the acclimatization of fish. By Thomas E. B. Pope. Document 634, 22 p., pl. i–iii, 1 map. (Issued July 16, 1908.)

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REPORT OF THE COMMISSIONER OF FISHERIES FOR THE FISCAL YEAR ENDED JUNE 30, 1907

Bureau of Fisheries Document No. 629

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REPORT

OF THE

COMMISSIONER OF FISHERIES.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF FISHERIES,
Washington, December 1, 1907.

SIR: I have the honor to submit a report of the operations of the Bureau of Fisheries during the fiscal year ended June 30, 1907.

FISH-CULTURAL WORK.

In its general lines the fish-cultural work varies little from year to year, the changes appearing as a rule only in the conditions which attend the taking of eggs and the hatching, and in the quantity of fish produced. The scope of the work is being constantly extended, however, including each year one or two kinds of fish not previously cultivated and adding localities to the field of operations.

OUTPUT.

The total output in 1907 was 2,511,597,377 fish and eggs—nearly 600,000,000 more than for the year 1906, which had the largest previous record. The conspicuous increases were in pike perch, yellow perch, and white perch, blueback salmon, lake cisco, grayling, shad, striped bass, cod, and lobster, with a fair yield of pollock and a comparatively large product of haddock, neither of which were hatched in 1906. On the other hand, the output of whitefish, chinook and silver salmon, and steelhead trout fell below the figures for last year. The number of fish and eggs distributed in 1907 is shown by species in the following table:

SUMMARY OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1907.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish			168,426	168,420
Shad	635,000	70,594,150		71,229,156
Whitefish	89,899,000	226,218,000		316,117,000
Lake cisco	9,040,000	50,000,000		59,040,000
Chinook salmon	78,587,705	17,567,092		96,154,797
Silver salmon	160,000	3,636,952		3,796,952
Blueback salmon		58,835,055		58,835,055
Humpback salmon			11,641	11,641
Steelhead trout	150,000	1,235,834	79,218	1,465,052
Rainbow trout	599,500	298,915	2,056,177	2,954,592
Atlantic salmon		2,156,852	39,830	2,196,682

SUMMARY OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1907—Continued.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Landlocked salmon	150,000	177,886	249,723	577,609
Blackspotted trout	490,000	5,323,130	1,382,050	7,195,180
Loch Leven trout			67,000	67,000
Lake trout	23,520,000	27,344,532	3,388,600	54,253,132
Brook trout	921,237	5,434,302	3,504,348	9,859,887
Sunapee trout		213,163		213,163
Grayling	200,000	1,814,200		2,014,200
Pike			8,000	8,000
Crappie and strawberry bass		700	25,437	26,137
Rock bass		6,542	30,305	36,847
Warmouth bass			1,812	1,812
Small-mouth black bass		102,600	26,844	129,444
Large-mouth black bass		42,355	463,935	506,290
Sunfish or bream		5,900	56,070	61,970
Pike perch	257,150,000	370,773,000		627,923,000
Yellow perch	10,400,000	257,228,700	14,665	267,643,365
Striped bass	2,000,000	6,737,500		8,737,500
White perch		249,169,000		249,169,000
Cod		235,422,000		235,422,000
Flatfish		178,625,000		178,625,000
Haddock		2,499,000		2,499,000
Pollock		86,299,000		86,299,000
Tautog		450,000		450,000
Lobster		167,909,000	494	167,909,494
Total	473,902,442	2,026,120,360	11,574,575	2,511,597,377

Cod and lobsters.—The work at the marine hatcheries was especially successful, the total output of cod and lobsters being greater than ever before. The Norwegian method of obtaining cod eggs was tested at Woods Hole with such encouraging results that the Bureau is considering the extension of this method to all the marine stations. From various parts of the New England coast is received the gratifying report of an evident increase in the abundance of small lobsters.

Whitefish.—Severe storms which prevailed on Lake Erie during the fall interfered somewhat with the collection of eggs of this species and caused the loss of a considerable number of brood fish, but on the whole the results were satisfactory.

Pike perch.—The output of pike perch is very gratifying. The development of the field at Swanton, Vt., auxiliary to the St. Johnsbury station, supplemented the pike-perch work on the Great Lakes, and was not a small factor in the success of the season.

Yellow perch and white perch.—The propagation of these two fishes is limited in possible extent only by the funds available for the work and the number of stations where the equipment is suitable. The collections of yellow-perch eggs are steadily increasing and the work with this species, as also with the white perch, can profitably be extended to other Atlantic rivers.

Black bass.—The demand for large-mouth and small-mouth black bass continues to exceed the supply. As stated in previous recommendations to Congress, there is a great need for additional pond-culture stations, especially in the Southern States. There was an average output last season.

Shad.—The scarcity of the shad in many of the eastern coastal streams, which has been so often discussed in the Bureau's reports, continues. A fairly successful season obtained on the Potomac and Susquehanna rivers, however, partly from the fact that heavy winds blew out the pound nets and prevented fishing in the lower parts of Chesapeake Bay, thus permitting the fish to ascend to the spawning grounds in the rivers. At Edenton, N. C., a large proportion of the eggs—nearly 19,000,000—were obtained from gill and pound nets, while the seine fishery at Avoca, usually the main dependence of the Edenton hatchery, furnished but 5,000,000. The protection of the shad in Albemarle Sound has already afforded results, and it is believed that the State law now in force will enable the station to obtain a much larger number of eggs from the gillers in future.

A new field in shad hatching was opened on the Pacific coast, 1,245,000 eggs having been taken in Willamette River. It is reported by the superintendent of the Clackamas station that with proper equipment 10,000,000 shad eggs can be taken there annually. As there is no regular commercial fishery for shad it is necessary for the Bureau to catch the fish from which to take the eggs.

In an effort to inaugurate shad catching in St. Johns River, Florida, the steamer *Fish Hawk* was sent to that locality, but only negative results were obtained, owing to inability to secure ripe fish.

Striped bass.—The three years' operations at Weldon have demonstrated the possibility of propagating striped bass in North Carolina, and the 6,514,000 eggs secured in 1907 yielded 3,680,000 fry. Difficulty is experienced, however, in obtaining ripe fish.

The propagation of striped bass was also taken up, experimentally, on the Pacific coast, under the supervision of the superintendent of the Baird (Cal.) station, in cooperation with the California Fish Commission. Eggs were collected on the San Joaquin River at Bouldin Island, where a temporary building was erected. It is interesting to note that during the first season's efforts 18,705,000 eggs were secured—more than have ever been taken in any one season in North Carolina. With better hatching facilities another season, it is believed that highly satisfactory results can be obtained.

Atlantic salmon.—The number of Atlantic salmon hatched very nearly approached the best previous record. The output is regulated very largely by the number of mature fish that can be purchased from commercial fishermen.

Trouts.—It seems unnecessary to call attention specifically to the results of the work with all the various trouts. The output of brook trout depends to some extent on the amount of money available for the purchase of eggs from commercial fish culturists, this source of supply being more economical than collecting from wild fish. The demand for rainbow trout continues to be so great that, although the

stock available for distribution in 1907 was larger than ever before, it was not sufficient to meet all applications. A new station established in California furnished the most satisfactory eggs handled during the season, and is expected to become a valuable source of supply for the hatcheries. Attempts to collect eggs of the golden trout of Volcano Creek, California, were unavailing, the snow and ice on the heights over which it is necessary to pass making it impossible to transport the necessary equipment during the spawning season. Later in the year, however, brood fish were secured and sent to three stations, with a view to artificial propagation.

The hatchery at Northville, Mich., was taxed to its utmost capacity during the past lake trout season, 47,000,000 eggs being laid down in the troughs at one time. This station supplies practically all the lake trout eggs handled by the Bureau.

Pacific salmons.—The product of blueback salmon was increased this year by the large output of the Yes Lake station in Alaska. This station, which is now practically completed, has fully demonstrated the desirability of its location. With the chinook salmon, the work at several important points was less successful than usual, because of adverse weather conditions. The racks at Baird, Cal., were washed out during the early run of salmon, and almost the entire collection of eggs was lost. At Baker Lake, Washington, more salmon were caught for the retaining pounds than during any preceding season in the history of the station, but an unprecedented rise in the lake released many of the impounded fish, and thus the total number of eggs secured was not large. The work at the field station of Birdsview, which is operated for humpback and silver salmon and steelhead trout, was also much interfered with by freshets.

The abundance of salmon in the Sacramento River is evidenced by the fact that the Mill Creek substation secured over 40,000,000 eggs—its largest take. The work at Mill Creek is as productive as that of any other station on the Pacific coast, and warrants the establishment of a hatchery there.

DISTRIBUTION OF THE OUTPUT.

The marine and anadromous fishes and the output of the hatcheries on the Great Lakes, all commercial species and constituting about 90 per cent of the total output, were as usual planted directly by the Bureau or consigned to State fish commissions. Practically all the other fishes, except those returned to the streams from whose overflow waters they had been taken, were distributed on application, as heretofore, being sent to individuals throughout the country for stocking ponds, lakes, streams, and reservoirs. The applications in

1907 numbered 6,346, which is 540 more than were received in 1906. The number of applications has grown steadily during the past few years.

The distributions in 1907 required travel amounting to 83,840 miles by the Bureau's six cars, and 263,196 miles by detached messengers—a total of 347,036 miles—of which 11,826 for cars and 80,816 for messengers were furnished free of charge. The operation of the new interstate commerce law and the railroad rate laws of various States will seriously increase the cost and difficulty of the Government's distribution of fishes. Where formerly railroads granted free transportation to cars and messengers, or charged but a moderate rate, it has become necessary in some States to pay full fares, and in the detached messenger service to ship the fish by express, while it is an unsettled question whether or not the messengers will be admitted to the express cars to care for the fish. The effect of these laws has already been felt, and indicates that the cost of transportation of fish during the next year will be practically twice what it has been heretofore.

STATIONS.

New stations and improvements.—The hatchery and other buildings at Yes Bay, Alaska, were completed and the station put in full operation in 1907. This makes the number of the Bureau's permanent stations 34, besides which numerous auxiliaries were in operation during the season. Another hatchery in Alaska will be located on a plateau on the east side of Litnik Lake, Afognak Island. A stream emptying into the lake near by will afford an ample water supply, taken from a point above some rapids 10 feet higher than the lake and about 1,200 feet distant. Material and supplies have been purchased and shipped, labor employed, an old cannery near at hand repaired to serve as a temporary storehouse, a sawmill set up, and the cutting of logs for lumber begun. The construction of the hatchery was thus well under way at the close of the fiscal year.

At Craig Brook, Me., the antiquated and unsuitable structure formerly in use has been replaced by a new one-story frame hatchery, 32 feet by 70 feet, with basement and attic. The new building contains suitable storage and work rooms, is heated by steam, and will accommodate 14 double troughs, 13 feet long by 2 feet 8 inches wide, holding 1,600 trays, with a capacity for 10,000,000 brook-trout eggs.

A new salmon hatchery has also been constructed at Battle Creek, Cal. The building is of wood and is 142 feet long by 58 feet wide, and contains 192 troughs 15 feet long. The water power at this station has been increased by raising the dam at the head of the supply ditch.

The former steam plant at the Baird (Cal.) salmon station having become obsolete and worn out, electricity has been installed and all buildings have been equipped with electric lights. Arc lights at the seining grounds permit advantageous night work and with electrical power the pumps can be operated with considerable saving of labor and money.

At Manchester, Iowa, the capacity of the station has been increased and improved by the construction of a large breeding pond, 200 feet by 130 feet, and by relining the nursery-stock ponds with cement.

A nine-room frame house has been built for the superintendent at Put in Bay, Ohio.

At Tupelo, Miss., a steam pumping plant has been installed, and the wells which furnish the water supply have been deepened and enlarged.

A steamboat 61 feet long, especially equipped for the purpose, has been purchased for use in connection with lobster propagation on the Maine coast.

Personnel.—The successful results and large output of the stations in recent years bring added credit to the superintendents and employees responsible for the collection of eggs upon consideration of the difficulty of keeping skilled men in the service. The same class of employment in commercial life brings a remuneration one and a half to five times as great. With such competition the Bureau is handicapped by the inability to secure competent men or, securing them, to retain them.

BIOLOGICAL INQUIRIES.

The study of the habits, migrations, spawning, diseases, etc., of the aquatic animals sought by man, and the almost equally important study of the creatures that serve as food or act as enemies to those of economic value, is conducted from year to year as a fundamental branch of the work in behalf of the fisheries. It was continued in 1907 upon the usual lines, in several cases being supplemented by direct experiment with immediate commercial application.

OYSTER EXPERIMENTS.

Lynnhaven Bay, Virginia.—In the Bureau's experiments at Lynnhaven for the development of a commercial process for fattening oysters artificially, the only important problem yet awaiting solution is that of materially increasing the output of the plant. Considerable progress toward this end has been made during the past year, the yield of the claire in 1907 being 176 barrels, against 125 barrels in the preceding year; and, as with a given equipment the expenses of operation are not materially increased whatever the product, this

increase, if it can be carried further, as present conditions indicate, will result in sufficient margin between the cost of the treatment and the increased value of the fattened oysters to warrant its recommendation as a commercial process. The oysters fattened by this method are as fine as any placed on the market, and they have been used with satisfaction at some of the best hotels and clubs of New York, Philadelphia, and Washington.

Louisiana.—The experiments undertaken at the request of the Louisiana Shellfish Commission have been continued. The plantations established during the preceding fiscal year have all been successful, with the exception of one which was selected for the purpose of determining what could be done with certain apparently hopeless adverse conditions. In Barataria Bay, where there has been heretofore no oyster fishery whatever, the experiments have been so successful during the first year as to result in the establishment of a considerable industry, which already yields to the State of Louisiana in rentals alone an annual income about equal to the total expenditure of this Bureau in the entire State. The experiments in other localities are almost equally successful, but have not yet attracted the same attention. At the conclusion of the work a report will be presented covering not only matter of immediate importance to Louisiana, but the results of investigations having general application to the oyster industries of the country at large.

Maryland.—In accordance with an act of Congress and at the request of the governor of Maryland, the Bureau has rendered assistance to the Maryland Shellfish Commission in a survey of the oyster beds of that State, detailing an assistant to act in an advisory capacity, and lending a launch and crew and various instruments. The work, which is being done in cooperation with the Coast and Geodetic Survey, is the most complete of the kind and is a necessary preliminary to the restoration of Maryland to her former position as the first oyster-producing State.

SPONGE EXPERIMENTS.

The series of disasters which for several years have pursued these experiments culminated in the almost total destruction of the plantation at Cape Florida by the great hurricane of October, 1906. Notwithstanding the difficulties with which this work has been beset, however, satisfactory progress has been made during the past year, and it is believed that by the end of next June a report can be issued recommending a commercial system of sponge culture. In view of the more rapid depletion of the natural beds, which will undoubtedly result from recent changes in the methods of the fishery, the Bureau is convinced that the preservation of the American sponge industry

will depend upon cultivation, and the speedy conclusion of these experiments will be a source of satisfaction. It is estimated that about $1,500,000 worth of sponges were taken in Florida during the past year, and the failure of the fishery, therefore, would be the ruin of one of the important industries of the State.

TERRAPIN EXPERIMENTS.

The experiments to develop a system of terrapin culture, conducted on the Choptank River in Maryland, have been continued. During the past year a considerable number of eggs were laid and hatched, and the habits and growth of both young and adults were closely studied. There appears to be little difficulty in inducing the diamond-back terrapin to breed in captivity, but the rate of growth is so slow as to make it uncertain whether artificial culture can be made a commercial success. The work will be continued until definite results are attained.

MARINE BIOLOGICAL LABORATORIES.

The two marine laboratories of the Bureau, at Woods Hole, Mass., and Beaufort, N. C., were engaged as usual in studies of the adjacent waters. At Woods Hole the biological survey was continued by supplemental dredgings to verify doubtful results and to supply specimens for a study of the materials of the sea floor in their relation to the distribution of plants and animals, and by systematic shore collections to develop the distribution of the plants and animals of the littoral. Sufficient material has now been gathered to furnish approximately complete and accurate data for a comprehensive report on the flora and fauna of the region, and considerable progress has been made in identifying the collections and digesting the results. The reference museum of the local fauna has been improved until it now contains a fairly representative set of specimens authoritatively identified by specialists.

Thirty-two investigators availed themselves of the facilities of the laboratory. Their work was of varied character, embracing some investigations of great importance to the fisheries, chief of which was the continuation of an inquiry into the food value of certain hitherto unused marine animals. It is believed that species such as the dogfish, not only of little present value but often a menace to the other fisheries, may be made an important source of income to the fishermen.

At Beaufort considerable progress was made in the study of the local fauna and its relations to the fisheries. A number of investigators were accommodated at the laboratory. The habits of fishes and other marine animals were studied, and experiments in the artificial raising of sponges and in clam and oyster culture were carried on in continuation of the work of the preceding year. The seaweeds of

the vicinity of Beaufort were studied, also, in the hope that, as the algæ of Japan support a profitable industry, it may be possible to develop the corresponding resources of the United States.

EXPLORATIONS AND SURVEYS.

North Pacific and Japan.—At the beginning of the fiscal year the *Albatross*, which had been dispatched in May on a cruise to investigate the salmon fisheries and the distribution of fishes in the north Pacific, had reached Hakodate, Japan, and from that time until she returned to San Francisco Bay she was steadily employed in that work. The results accomplished were of high scientific importance and the voyage was prosperous in every respect until the night of November 21, when, homeward bound, the commanding officer, Lieut. Commander L. M. Garrett, U. S. Navy, was lost overboard. Captain Garrett took command of the vessel on October 3, 1904. He had previously served as executive officer, and his familiarity with the ship and her work rendered him a valuable officer. His untimely death under such peculiarly distressing circumstances was a source of profound regret to the Bureau.

Sebago Lake, Maine.—During the summer and fall of 1906, in continuation of the general plan for the biological and physical study of the principal fresh waters of New England, a party carried on investigations in Sebago Lake. Many artificially hatched salmon and trout have been planted in this lake and contiguous waters, and the locality affords a good field for the investigation of the effects of fish culture in modifying the fauna. The habits of the local Salmonidæ, their food, breeding, and environment, were the subject of particular study.

Lake Maxinkuckee, Indiana.—The investigations which have been conducted at Lake Maxinkuckee at intervals for a number of years past were continued from July to November of the present fiscal year. The food, parasites, and diseases of fishes and the habits of the fresh-water mussels received special attention. The mussel investigations are of particular importance in view of the depletion of the natural beds of the Mississippi Valley under the demands of the pearl-button industry. This industry is now yielding an annual product worth about $5,000,000.

COMMERCIAL AND STATISTICAL INQUIRIES.

The commercial fisheries of the United States, exclusive of its insular possessions, at the present time represent an investment of nearly $90,000,000, which yields an annual income of nearly $60,000,000. The general condition of the industry is good and the trend is upward, although a few important branches are in a state of established or impending decline. The mackerel fishery was ex-

ceptionally poor in 1906, owing to a continued scarcity of fish, but the outlook for 1907, as shown by the spring catch, was remarkably favorable. The yield of halibut was smaller, but the catch of cod, haddock, and other ground fishes was large. While the catch of lobsters was less than formerly, there have been local evidences of a greater abundance which are by many people regarded as a forerunner of general improvement. The Pacific cod and halibut fisheries showed a slight decline, but the salmon fishing and canning industry exhibited some increase. The shad fishery on the Atlantic rivers in the spring of 1907 was more productive than in the previous year, owing to a greater abundance of fish, but the conditions are quite unsatisfactory. The capture of increasing quantities of mature shad on their way to the spawning grounds demands concerted movement of the various States for protective legislation. In the most important of all our fisheries, the oyster, there is to be noted a healthy condition, owing to growing dependence on cultivation.

NOTES ON IMPORTANT FISHERIES.

Boston and Gloucester.—A good criterion of the extensive New England vessel fisheries is afforded in the trade centering at the two great markets of Boston and Gloucester, where an aggregate of 170,401,210 pounds of fish, having a value of $4,072,362, was landed by American vessels in 1906. Of this immense quantity 129,230,658 pounds, worth $2,808,228, were secured on grounds lying west of the sixty-sixth degree of west longitude—that is, directly off the New England coast.

Mackerel.—The total catch of salted mackerel in 1906 was approximately 10,448 barrels, valued at $171,970, which includes 4,376 barrels taken on the Cape shore and in the Gulf of St. Lawrence. This quantity falls short of the 1905 catch by 18,853 barrels. The catch of fresh mackerel was 35,240 barrels, representing a value of $423,000. This quantity was 14,672 barrels less than was taken in the previous year.

The condition of the mackerel fishery is viewed with considerable alarm. The methods involve great expense, and the baffling movements of the fish for the last few years, with consequent poor catches, have caused heavy losses. The scarcity is widespread, according to the annual report of the Boston Fish Bureau, which states that the world's catch of salted mackerel in 1906 was but 99,137 barrels, divided among various countries as follows: United States, 10,138 barrels; Canada, 30,000 barrels; Ireland, 30,000 barrels; Norway, 28,999 barrels. The total catch of these countries in 1905 was 185,094 barrels, or 85,957 barrels more than in 1906.

Cod.—In 1906 there were landed at Boston and Gloucester 36,195,616 pounds of fresh and 18,323,093 pounds of salted cod, an

increase of 529,156 pounds over the total quantity landed in the previous year. Of the 1906 catch 39,090,106 pounds were taken on banks west of the sixty-sixth meridian.

The catch on the Pacific coast shows a slight decrease compared with the previous year. The total number of fish landed at San Francisco and Puget Sound ports was 3,527,118, of which 2,407,500 were landed at the more southern points and 1,119,618 in the northern region. This catch represents 14,108,472 pounds, a decrease of 459,528 pounds, or 114,882 fish, the average weight of the fish being reckoned at 4 pounds.

Herring.—The American fleet engaged in the herring fishery in Newfoundland waters in 1906 consisted of 62 vessels, in addition to which 4 Canadian vessels were chartered by American fishermen. There were also engaged in the fishery 27 Canadian and 55 Newfoundland vessels, the latter mostly small craft. American vessels employed, in addition to their regular crews, 780 native fishermen shipped outside the three-mile limit. The fishery was prosecuted in practically the same manner as in the previous year, with the exception that a few purse seines were used early in the season. Although the weather was unusually severe, the catch was large, that of the American fleet amounting to 72,309 barrels of frozen and salted herring, valued at approximately $392,340. Six American vessels were lost.

Haddock.—This fishery has shown marked development in the last few years, employing larger and improved vessels, and yielding a larger catch. In 1906 the quantity taken amounted to 47,724,050 pounds landed at Boston and 13,871,787 at Gloucester, a total of 61,596,837 pounds, valued at $1,136,426. Since the beginning of 1907, however, the supply of fresh haddock has at times exceeded the demand, and many trips were split and salted.

Pollock.—The supply of pollock in the Boston and Gloucester markets in 1906 fell short of the 1905 yield by 12,000,000 pounds, being 9,510,262 pounds, valued at $115,173, against 22,055,789 pounds, valued at $216,534. Notwithstanding this large decrease, however, the fishery as a whole is growing in importance. Pollock have been unusually plentiful, and many large catches have been made in a very short time. The fish are taken at all seasons, but the principal fleet, composed mostly of small craft, is occupied in the fall.

Hake and cusk.—These fish, although not so erratic as pollock, are much more abundant some years than others. In 1905 there were marketed at Boston and Gloucester 32,265,471 pounds of hake and cusk, against which 1906 afforded only 18,617,957 pounds, a decrease of 13,647,514 pounds. Considering the last few years, however, the fishery has shown a gratifying increase.

Flounders.—The flounder fishery on both the Atlantic and Pacific coasts is increasing in importance. The catch landed at New England ports, of which Boston is the principal market, is about 5,500,000 pounds annually, with a value of $150,000. The Middle Atlantic States produce a little over 3,000,000 pounds, worth $114,000, and the South Atlantic and Gulf States 400,000 pounds, worth $10,000. This is a total of 9,300,000 pounds for the Atlantic coast, while the Pacific States produced 4,550,000 pounds. The flounder catch of both coasts has a value of approximately $360,000.

Swordfish.—The increasing demand for swordfish in the last ten years has directed considerable attention to this fishery. The catch in 1906 was 3,296,369 pounds, valued at $204,637, which is about twice the quantity and value of the catch two years previous.

Halibut.—On the Atlantic coast in the last ten years this important fishery has greatly declined. The catch in 1906, however, was considerably in excess of that of 1905, being 4,654,446 pounds, against 3,715,776, a gain of 938,670 pounds and $78,436. The quantity of halibut landed at Gloucester in 1906 exceeds that landed at Boston the same year by 3,509,946 pounds and $232,468 in value. Of the total quantity, 635,881 pounds was salted, all of it marketed at Gloucester. The increase in the catch is attributed to the fact that the banks have not for a number of years been so extensively fished as formerly, the fleet at the same time having decreased about two-thirds. The halibut has thus had time to reestablish itself. Up to the close of the fiscal year 1907 the catch on the Atlantic coast approximated that for the corresponding period of 1906.

The large catches on the Pacific halibut grounds for the past fifteen years have brought a considerable number of steam and sailing vessels into this fishery, and the grounds have been very thoroughly fished. A consequent scarcity of fish is said to have existed on some important grounds in 1906, but the increased yield of the Atlantic banks lessened the demand for Pacific halibut, and thus limited the catch for that year. The quantity taken is estimated to have amounted to about 11,000,000 pounds, however, which is 6,000,000 pounds more than the catch on the Atlantic coast.

Alaska salmon.—The new laws governing the fisheries of Alaska did not become operative until so late in the fishing season of 1906 that they were without effect during that year, and the annual inspection revealed practically unchanged conditions, though the several branches showed fluctuations in output. The pack of canned salmon was unusually large—the best since 1903—and the goods brought remunerative prices, making the season a prosperous one. The agitation concerning the meat-packing plants in Chicago led to some distrust in European markets of American canned salmon, but the exceptional care and cleanliness which prevails in the salmon-pack-

ing establishments served to dispel the prejudice, and the demand in foreign markets soon became normal. The earthquake and fire in San Francisco also affected the salmon industry, through the destruction of vessels and the dispersal of cannery employees. The number of canneries operated, however, was nevertheless greater than in the previous year, being 47, against 42 in 1905. The total pack of all kinds of salmon was 2,246,989 cases, valued at $7,896,392.

The pickling of salmon, the oldest branch of the salmon industry, is declining, the mild-cured product now being more in demand. The salteries in 1906 yielded an output of 16,926 barrels and 3,389 half barrels, worth $139,838. Ten firms and individuals engaged in mild curing, putting up 1,294,900 pounds of salmon, worth $67,007, in their initial season.

Four hatcheries were operated in Alaska in 1906, three by different firms, and one by the Bureau of Fisheries. The first season for the latter (1905–6) resulted in an output of 6,638,550 sockeye fry. The output of all the hatcheries that season amounted to 104,817,962 sockeye and 1,837,000 coho fry. In the fall of 1906 the hatcheries contained 205,909,200 sockeye, 30,000 coho, and 182,000 steelhead eggs, of which 58,210,000 of the sockeyes and all the steelhead trout were in the Government hatchery at Yes Lake.

As a result of the inspection of 1906 several recommendations have been submitted, viz, that Eyak River and Lake, on Prince William Sound, be declared a salmon-spawning reservation, to permit the reenforcement of adjacent waters; that the salting of salmon bellies by processes that do not make use of any other part of the fish be prohibited; that Indians be prohibited from taking salmon with gaff hooks in the Chilkoot and Chilkat rivers for sale to the canneries; and that Wood River be closed to commercial fishing and a salmon hatchery be established on the chain of lakes at its head.

ADMINISTRATION.

MOVEMENTS OF VESSELS.

The *Albatross* completed the explorations in the Northern Pacific Ocean and Japanese Archipelago the latter part of October and sailed for home from Yokohama November 10, 1906, arriving in San Francisco December 10. The wear and tear of the long cruise just completed and the operations of the previous year necessitated an extensive overhauling of hull, machinery, and rigging before another extended expedition could be undertaken, and accordingly arrangements were made with the Navy Department to have the vessel put in cruising condition at the Mare Island Navy-Yard. The work was begun February 18, 1907, and at the close of the year was nearly finished.

The steamer *Fish Hawk* continued the experimental shad work on the Kennebec River until the end of the season, then during the remainder of the summer of 1906 was utilized in biological survey of Buzzards Bay. In the fall she was sent to Florida waters to assist the efforts toward the propagation of mullet and later of shad in the St. Johns River. At the close of the year she was in Hampton Roads in connection with the exhibit of the Bureau at the Jamestown Exposition.

The schooner *Grampus* was engaged in the collection of egg-bearing lobsters for the Maine hatchery and the planting of young lobsters along the Maine coast till the latter part of September. She was then dismantled at Gloucester, Mass., in anticipation of the extensive repairs provided for by act of Congress, and her crew was detailed to assist in the work of the Gloucester station. A bid for the repairs having been accepted from a firm in Boothbay Harbor, Me., the vessel was dispatched to that point in June, 1907.

JAMESTOWN EXPOSITION.

In the act of Congress directing the participation of certain Government departments and bureaus in the Jamestown Ter-Centennial Exposition near Norfolk, Va., the Bureau of Fisheries was specifically mentioned and provision was made for a fisheries building, including an aquarium. Preparations were begun in September under the direction of the representative on the Government board for the Department of Commerce and Labor, and the first shipment of material was made the latter part of January. The exhibit was in place and ready on the opening day, April 26, but owing to lack of electrical power and an adequate supply of fresh water, both of which important factors were to have been furnished from outside sources, it was necessary to postpone opening the aquarium for one week.

The building provided is connected with Government building "A" by a colonnade and contains 6,200 square feet of space, of which 2,650 square feet are occupied by the aquaria and entrances. The aquarium consists of 19 tanks arranged about the sides of the building and a central pool for seals, turtles, and other large animals. Owing to the desirability of giving particular attention to an exhibit of marine life, but small space was left available for illustration of the functions of the Bureau by a fixed exhibit, and only a select number of models, apparatus, etc., pertaining to the more salient or interesting phases of the work, could be displayed.

PUBLICATIONS AND LIBRARY.

The Bureau's publications in 1907 amounted to 1,077 pages and included 15 pamphlet articles. The Bulletin was carried into its twenty-sixth volume. The number of pamphlets supplied to ad-

dresses on the regular mailing list was 6,405, in response to requests 14,290 were sent out, and the authors of the respective papers received 531, the total distribution being 21,226.

Accessions to the library numbered 325 bound volumes and 638 unbound books and pamphlets. Purchases have as usual been restricted to books of reference and those bearing directly on the work of the Bureau.

INTERNATIONAL RELATIONS.

At the request of the Department of State an assistant of the Bureau was dispatched to Newfoundland, as in the previous year, to note the progress and condition of the American herring fishery on the so-called "treaty shore" and to keep the Government informed regarding the developments under the modus vivendi. The naval tug *Potomac* was placed at the disposal of the Bureau's representative, and remained on the grounds during the entire season, which lasted from the latter part of September to the middle of January. No special complications over the fishery question arose.

A number of requests for fish eggs were received through diplomatic channels, and 3,797,500 were thus donated to foreign governments. This number comprised 87,500 rainbow trout eggs, destined for the private preserves of the Emperor of Japan at Nikko; 10,000 steelhead trout eggs for the national fish hatchery at Nancy-Bellefontaine, France; and 2,000,000 whitefish, 1,000,000 lake cisco, and 500,000 chinook salmon eggs for New Zealand. The success attending the introduction of rainbow trout and other American fishes into New Zealand is well known, and it is a matter of great economic and scientific interest that runs of blueback, or sockeye, and chinook salmon have recently been established in rivers of that colony.

APPROPRIATIONS.

The appropriations for the Bureau for the fiscal year 1907 were as follows:

Salaries	$276, 820
Agents at Alaska salmon fisheries	4, 500
Miscellaneous expenses:	
Administration	12, 500
Propagation of food fishes	250, 000
Inquiry respecting food fishes	25, 000
Statistical inquiry	7, 500
Maintenance of vessels	55, 000
Purchase of additional land, improvements, and completion of stations at—	
Wytheville, Va	5, 000
Cold Springs, Ga	2, 000
Erwin, Tenn	50

For construction and repair of buildings and improvements of water supply at—	
Manchester, Iowa	$7,000
Baird, Cal	10,000
For care of fish ponds, Monument Lot	300
For repairs to schooner *Grampus*	7,500
For purchase of steam launches at—	
Yes Bay, Alaska	8,000
Boothbay Harbor, Me	5,000

In accordance with law the expenditures under these several appropriations will be made the subject of a special report.

RECOMMENDATION.

NEW BUILDING AND PUBLIC AQUARIUM.

Attention is again directed to the inadequate and obsolete quarters occupied by the Bureau of Fisheries in Washington, with emphasis upon the necessity for a new office building containing special laboratory facilities that are now lacking. Much of the work of the Bureau in the interests of the fisheries and fish culture requires for its successful accomplishment fresh and salt water tanks in which experimental investigations may be conducted. The absence of such tanks at headquarters has greatly retarded progress and in some cases has necessitated the indefinite postponement of important inquiries.

In conjunction with the desired new office building there should be maintained a modern aquarium, which would be a place of great public interest and educational value and at the same time of practical utility to the Bureau. The facilities already possessed by the Bureau for stocking and operating such an aquarium would permit its maintenance at a trifling cost. Attention is called to references to a national aquarium in the report of the Secretary of Commerce and Labor for 1903.

Respectfully,

GEO. M. BOWERS,
Commissioner.

To Hon. OSCAR S. STRAUS,
Secretary of Commerce and Labor.

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THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1907

Bureau of Fisheries Document No. 630

PREFACE.

The demand for information concerning the stocking of waters by the Bureau of Fisheries indicates an interest on the part of the public which, in addition to the permanent value of the record from the fish-culturist's standpoint, has led to the yearly publication of an extended account of this work. Such details, however, no longer included in the Annual Report of the Commissioner, are now presented as detached supplementary reports. Following is a record of the distribution of fish and fish eggs during the fiscal year 1907.

GEORGE M. BOWERS,
Commissioner.

JANUARY 15, 1908.

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Large-mouth black bass	63
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Pike perch	74
Yellow perch	75
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THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1907.

CHARACTER OF THE WORK.

About nine-tenths of the output of the fish-cultural stations consists of important commercial species, notably the salmons, shad, whitefish, pike perch, yellow perch, white perch, lake trout, cod, pollock, flatfish, and lobsters. These are hatched in lots of many millions annually and planted by the Bureau, the fresh-water species principally in the large coastal streams and in the Great Lakes, the marine species upon the inshore fishing grounds of the Atlantic.

The cultivation of the fishes of the interior waters generally classed as game fishes, although a comparatively small factor in the total output, is a very important feature of the Bureau's work, supplying as it does various kinds of young fish for public streams, lakes and ponds, fishing preserves, private ponds, streams, etc., in all parts of the United States. Among the fishes most extensively cultivated for these purposes are the landlocked salmon, several species of trout, the grayling, the basses, crappie, bream, and catfish; but various others also are handled. The trouts are artificially hatched from eggs taken from both wild and domesticated stock; the basses, catfishes, and others are derived from mature fish held in ponds for breeding purposes, or (except the small-mouth black bass) they are rescued from the overflows of the Mississippi and Illinois rivers. Collections from the latter sources include also pike, yellow perch, buffalo-fish, and several others, which are usually returned immediately to the main streams.

METHOD OF DISTRIBUTION.

The first consideration in the Bureau's distribution of fishes is to make ample return to the waters from which eggs or fish have been collected. The remainder of the product is consigned to suitable public or private waters on application which is endorsed by a United States Senator or Representative. The fish are carried to

their destination in railroad cars equipped for the purpose, or by messengers who accompany the shipments in baggage cars, and are delivered to the applicant, free of charge, at the railroad station nearest the point of deposit. During the past fiscal year (July 1, 1906, to June 30, 1907), the Bureau received 6,346 applications for fish, nearly all for the game species. The demand, especially for the basses, crappie, and the catfishes, is greater than can be met with present resources.

ALLOTMENTS.

The supply of particular fishes available for distribution, and consequently of the number allotted to individual applicants, is largely determined by the difference in methods of hatching the different species and the present facilities therefor. The area and character of the water to be stocked, however, must likewise be considered; the water area that would receive a million pike perch fry would perhaps be assigned no more than 200 or 300 black bass 3 or 4 inches long, or four to eight times that many if the bass were planted as fry. The explanation is in the fact that pike perch can be propagated by the hundred million, while black bass, hatched by other methods or collected from overflowed lands, can be produced only in comparatively small numbers. The Bureau does not attempt to assign any applicant more than a liberal brood stock of the basses or sunfishes. With brook trout, which are distributed both as fry and fingerlings, allotments of fry are many times larger than allotments of fingerlings 3 to 4 inches long.

SIZE OF FISH WHEN DISTRIBUTED.

Fishes are distributed at various stages of development, according to the species, the numbers in the hatcheries, and the facilities for rearing. The commercial fishes—such as the shad, whitefish, lake trout, pike, perch, cod, etc., hatched in lots of many millions—are necessarily planted as fry. It is customary to distribute them just before the umbilical sac is completely absorbed. Atlantic salmon, landlocked salmon, and various species of trout, in such numbers as the hatchery facilities permit, are reared to fingerlings from 1 to 6 inches in length; the remainder are distributed as fry.

The basses and sunfishes are distributed from the fish-cultural stations and ponds from some three weeks after they are hatched until they are several months of age. When the last lots are shipped the basses usually range from 4 to 6 inches and the sunfishes from 2 to 4 inches in length. The numerous fishes collected in overflowed lands—basses, crappie, sunfishes, catfishes, yellow perch, and others—are 2 to 6 inches in length when taken and distributed.

Eggs are distributed only to state hatcheries or to applicants who have hatchery facilities.

The varying usage in the classification of young fish as to size has caused such confusion and difficulty that the Bureau has adopted uniform definitions, as follows:

Fry=fish up to the time the yolk sac is absorbed and feeding begins.

Advanced fry=fish from the end of the fry period until they have reached a length of 1 inch.

Fingerlings=fish between the length of 1 inch and the yearling stage, the various sizes to be designated as follows: No. 1, a fish 1 inch in length and up to 2 inches; No. 2, a fish 2 inches in length and up to 3 inches; No. 3, a fish 3 inches in length and up to 4 inches, etc.

Yearlings=fish that are 1 year old, but less than 2 years old from the date of hatching; these may be designated No. 1, No. 2, No. 3, etc., after the plan prescribed for fingerlings.

SPECIES CULTIVATED IN 1907.

The following full list of species that the Bureau was concerned with in 1907 includes some 50 fishes and the lobster. Except as otherwise indicated by footnotes, all were artificially propagated.

THE CATFISHES (SILURIDÆ):

[a] Spotted cat, blue cat, channel cat (*Ictalurus punctatus*).
[a] Horned pout, bullhead, yellow cat (*Ameiurus nebulosus*).
Marbled cat (*Ameiurus nebulosus marmoratus*).

THE MINNOWS AND CARPS (CYPRINIDÆ):

[b] Carp (*Cyprinus carpio*).
[c] Goldfish (*Carassius auratus*).
[c] Tench (*Tinca tinca*). Cultivated varieties, green tench and golden tench.
[c] Ide (*Leuciscus idus*). Cultivated variety, golden ide.

THE SHADS AND HERRINGS (CLUPEIDÆ):

Shad (*Alosa sapidissima*).

THE SALMONS, TROUTS, WHITEFISHES, ETC. (SALMONIDÆ):

Common whitefish (*Coregonus clupeiformis*).
Lake herring, cisco (*Argyrosomus artedi*).
Chinook salmon, king salmon, quinnat salmon (*Oncorhynchus tschawytscha*).
Silver salmon, coho (*Oncorhynchus kisutch*).
Blueback salmon, red-fish, sockeye (*Oncorhynchus nerka*).
Humpback salmon (*Oncorhynchus gorbuscha*).
Steelhead, hardhead (*Salmo gairdneri*).
Rainbow trout (*Salmo irideus*).
Atlantic salmon (*Salmo salar*).
Landlocked salmon (*Salmo sebago*).
Yellowstone Lake trout, cut-throat trout, black-spotted trout (*Salmo lewisi*).
Colorado River trout, blackspotted trout (*Salmo pleuriticus*).
Golden trout (*Salmo roosvelti*).

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[a] Artificially propagated and also collected.
[b] Propagated principally as food for other fishes.
[c] Introduced species, propagated for ornamental purposes (not distributed).

THE SALMONS, TROUTS, WHITEFISHES, ETC. (SALMONIDÆ)—Continued.

[a] Sea trout (*Salmo trutta*).
[b] Loch Leven trout (*Salmo trutta levenensis*).
Lake trout, Mackinaw trout, longe, togue (*Cristovomer namaycush*).
Brook trout, speckled trout (*Salvelinus fontinalis*).
Sunapee trout (*Salvelinus aureolus*).
Canadian red trout (*Salvelinus marstoni*).
Hybrid trout (*Salvelinus aureolus*).

THE GRAYLINGS (THYMALLIDÆ):

Montana grayling (*Thymallus montanus*).

THE PIKES AND PICKERELS (ESOCIDÆ):

[c] Pike (*Esox lucius*).
[c] Pickerel (*Esox reticulatus*).

THE BASSES, SUNFISHES, AND CRAPPIES (CENTRARCHIDÆ):

[d] Crappie (*Pomoxis annularis*).
Strawberry bass, calico bass (*Pomoxis sparoides*).
[d] Rock bass, red-eye, goggle-eye (*Ambloplites rupestris*).
[d] Warmouth, goggle-eye (*Chænobryttus gulosus*).
Small-mouth black bass (*Micropterus dolomieu*).
[d] Large-mouth black bass (*Micropterus salmoides*).
[d] Bluegill sunfish (*Lepomis pallidus*).
[c] Other sunfishes, chiefly *Eupomotis gibbosus*.

THE PERCHES (PERCIDÆ):

[d] Pike perch, wall-eyed pike, yellow pike, blue pike (*Stizostedion vitreum*).
[d] Yellow perch (*Perca flavescens*).

THE SEA BASSES (SERRANIDÆ):

Striped bass, rockfish (*Roccus lineatus*).
White perch (*Morone americana*).

THE CODS (GADIDÆ):

Cod (*Gadus callarias*).
Pollock (*Pollachius virens*).
Haddock (*Melanogrammus æglefinus*).

THE LABRIDS (LABRIDÆ):

Tautog, blackfish (*Tautoga onitis*).

THE FLOUNDERS (PLEURONECTIDÆ):

Winter flounder, American flatfish (*Pseudopleuronectes americanus*).

CRUSTACEANS:

American lobster (*Homarus americanus*).

OUTPUT.

On comparison with the previous year, the figures for 1907 exhibit as usual some striking fluctuations in the yield of particular species, with at the same time an enormous increase in the total. The suc-

[a] Introduced.

[b] Introduced, and propagated in limited numbers for observation under natural conditions.

[c] Rescued from overflows.

[d] Artificially propagated and also obtained by rescue from overflows.

cessful operations of the new hatchery in Alaska brought the number of blueback salmon this year to nearly six times as many as were produced in 1906. On the other hand, floods and freshets so interfered with the collection of eggs in Washington and Oregon that the output of chinook and silver salmon fell far behind. There were nearly a third less flatfish this year than last; but the phenomenal collection of lake trout eggs in 1906 was equaled, and there were large increases in pike perch, white perch, yellow perch, cod, and lobsters; and the shad plants were nearly doubled, through the fortuitous results of storms on the coast which prevented fishing in the lower waters of Chesapeake Bay and thus permitted fish to reach the spawning grounds. Striped bass, the propagation of which was undertaken three years ago in North Carolina, but has been scarcely more than experimental, make practical showing in 1907, by reason of very successful efforts on the Pacific coast; while pollock, propagated in comparatively insignificant numbers hitherto, are represented by over 86,000,000 fry. The yield of whitefish, lake trout, brook, rainbow, and blackspotted trout, and Atlantic salmon was about the usual.

SUMMARY OF THE OUTPUT OF FISH AND EGGS DURING THE FISCAL YEAR 1907.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish			168,426	168,426
Shad	635,000	70,594,150		71,229,150
Whitefish	89,899,000	226,218,000		316,117,000
Lake cisco	9,040,000	50,000,000		59,040,000
Chinook salmon	78,587,705	17,567,092		96,154,797
Silver salmon	160,000	3,636,952		3,796,952
Blueback salmon		58,835,055		58,835,055
Humpback salmon			11,641	11,641
Steelhead trout	150,000	1,235,834	79,218	1,465,052
Rainbow trout	599,500	298,915	2,056,177	2,954,592
Atlantic salmon		2,156,852	39,830	2,196,682
Landlocked salmon	150,000	177,886	249,723	577,609
Blackspotted trout	490,000	5,323,130	1,382,050	7,195,180
Loch Leven trout			67,000	67,000
Lake trout	23,520,000	27,344,532	3,388,600	54,253,132
Brook trout	921,237	5,434,302	3,504,348	9,859,887
Sunapee trout		213,163		213,163
Grayling	200,000	1,814,200		2,014,200
Pike			8,000	8,000
Crappie and strawberry bass		700	25,437	26,137
Rock bass		6,542	30,305	36,847
Warmouth bass			1,812	1,812
Small-mouth black bass		102,600	26,844	129,444
Large-mouth black bass		42,355	463,935	506,290
Bream or sunfish		5,900	56,070	61,970
Pike perch	257,150,000	370,773,000		627,923,000
Yellow perch	10,400,000	257,228,700	14,665	267,643,365
Striped bass	2,000,000	6,737,500		8,737,500
White perch		249,169,000		249,169,000
Cod		235,422,000		235,422,000
Flatfish		178,625,000		178,625,000
Haddock		2,499,000		2,499,000
Pollock		86,299,000		86,299,000
Tautog		450,000		450,000
Lobster		167,909,000	494	167,909,494
Total	473,902,442	2,026,120,360	11,574,575	2,511,597,377

ALLOTMENTS TO STATE FISH COMMISSIONS.

As usual, large numbers of eggs and young fish were last year consigned to state commissions. The various species represented and the distribution among the states is shown in the following table:

ALLOTMENTS OF FISH AND EGGS TO STATE FISH COMMISSIONS IN 1907.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
California:			
Chinook salmon	72,840,315		
Grayling	100,000		
Colorado:			
Blackspotted trout	100,000		
Connecticut:			
Lake trout	300,000		
Yellow perch		500,000	
Maine:			
Landlocked salmon	75,000		
Lake trout	200,000		
Brook trout	50,000		
Maryland:			
Rainbow trout	100,000	18,450	3,000
Bream		4,200	
Yellow perch	10,400,000		
White perch		10,000,000	
Massachusetts:			
Rainbow trout	50,000		
Landlocked salmon	10,000		
Brook trout	30,000		
Pike perch	3,000,000		
Michigan:			
Landlocked salmon	10,000		
Pike perch	50,000,000		
Lake trout	2,000,000		
Minnesota:			
Catfish			7,200
Black bass			5,100
Yellow perch			500
Missouri:			
Brook trout	100,000		
Pike perch	10,000,000		
Nebraska:			
Rainbow trout	97,000		
Nevada:			
Lake trout	100,000		
Brook trout	100,000		
New Hampshire:			
Chinook salmon	36,000		
Silver salmon	50,000		
Lake trout	500,000		
New York:			
Whitefish	5,000,000		
Lake trout	2,500,000		
Brook trout		180,990	
Oregon:			
Chinook salmon	3,550,000		
Pennsylvania:			
Whitefish	a 57,249,000		
Lake herring	8,040,000		
Rainbow trout	100,000		
Blackspotted trout	100,000		
Lake trout	2,500,000		
Pike perch	a 194,150,000		
Rhode Island:			
Lobster		231,000	
Vermont:			
Lake trout	500,000		
Brook trout	50,000		
Wisconsin:			
Whitefish	25,000,000		
Landlocked salmon	20,000		
Lake trout	14,500,000		
Wyoming:			
Steelhead trout	50,000		
Blackspotted trout	100,000		
Lake trout	50,000		
Grayling	100,000		
Total	463,807,315	10,934,640	15,800

a The Pennsylvania Fish Commission cooperated with the Bureau in the collection of whitefish and pike perch eggs in Lake Erie, and these quantities therefore do not represent allotments in the usual sense.

SHIPMENTS TO FOREIGN COUNTRIES.

The shipments of eggs to foreign countries in 1907 amounted to 3,797,500. The number of eggs of each species and the country receiving them are shown below:

SUMMARY OF DISTRIBUTION OF EGGS TO FOREIGN COUNTRIES DURING THE FISCAL YEAR 1907.

Country.	Species.	Number.
New Zealand	Whitefish	2,000,000
Do	Lake herring	1,000,000
Do	Chinook salmon	500,000
Japan	Rainbow trout	87,000
Canada	Lake trout	200,000
France	Steelhead trout	10,000
Total		3,797,500

WORK AND OUTPUT OF THE STATIONS.

The following tabulation lists all of the stations operated by the Bureau in 1907, and shows for each the period of operation, the kinds of fishes handled, and the number of fish and eggs produced. It shows also the character of the work in each locality and in some degree the relative importance of the stations. The last statement should be qualified, however, for particular instances. Some substations are more important in the actual fish-cultural work than are the stations to which they are, for purposes of administration, subordinate; but the output of these important substations is not always shown separate from that of the main hatchery. Such distinctions are indicated in the table by means of a scheme of type. All of the principal stations and all of the substations where eggs were hatched are printed in ordinary roman type. Substations which were merely collecting points, perhaps shifting in location from year to year, are printed in italics. Italics in the column of "Species handled," opposite substations of whatever class, indicate that the output, if any, is included with the output of that species credited to the main station. The transfers of eggs and fish from station to station are recorded in footnotes under the station from which taken, and the yield is credited to the receiving station. Transfers of eggs are frequent, serving convenience and economy in transportation to stations which are to be distributing centers for the respective species, for the shipment of eggs is easier and cheaper than the shipment of young fish.

STATIONS OPERATED AND THE OUTPUT OF EACH.

Name and location.	Period of operation.	Species handled.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Baird, Cal.	Entire year	Chinook salmon	2,984,015	2,512,250	
Battle Creek, Cal.	Oct. 1–Jan. 23	Chinook salmon	32,640,300		
Lone Pine, Cal.[a]	*Aug. 25–Sept. 24*	*Golden trout*			
Mill Creek, Cal.	Oct. 5–Feb. 19	Chinook salmon	37,752,000		
Stockton, Cal.	May 1–June 19	Striped bass	2,000,000	3,057,500	
Yreka, Cal.[a]	*Jan. 22–Mar. 27*	*Rainbow trout*			
Baker Lake, Wash.	Entire year	Blueback salmon		4,224,255	
		Silver salmon		998,352	
		Chinook salmon		12,848	
Birdsview, Wash.[a]	Entire year	Silver salmon	760,000	2,638,600	
		Chinook salmon		46,440	
		Steelhead trout		914,865	
Battery, Havre de Grace, Md.[a]	Mar. 6–June 27	Shad		18,774,000	
		Yellow perch	10,400,000	149,955,000	
		White perch		246,855,000	
Boothbay Harbor, Me.	Entire year	Cod		28,175,000	
		Lobster		137,500,000	
Johns Bay, Me.	*Entire year*	*Lobster*			
Kittery Point, Me.	*May 1–June 30*	*Lobster*			
Portland, Me.	*July 1–Oct. 31; May 1–June 30.*	*Lobster*			
Bozeman, Mont.[a]	Entire year	Brook trout	75,000		164,400
		Rainbow trout			82,600
		Steelhead trout			71,500
		Blackspotted trout			821,000
		Golden trout			
		Grayling	200,000	1,776,200	
Kilgore, Idaho	*Oct. 1–Feb. 5*	*Brook trout*			
Redrock, Mont.	Apr. 1–June 30	*Grayling*			
Bryans Point, Md.[a]	Mar. 6–May 29	Shad	400,000	34,867,000	
		Yellow perch		95,738,700	
Cape Vincent, N. Y.	Entire year	Whitefish		29,000,000	
		Lake trout		4,234,500	
		Brook trout		971,990	
		Pike perch		15,700,000	
Central Station and aquaria, Washington, D. C.	Entire year	Whitefish		468,000	
		Brook trout	200,000	13,200	
		Rainbow trout		26,715	
		Lake trout		28,000	
		Yellow perch		1,735,000	
		White perch		2,314,000	
		Pike perch		3,200,000	
		Large-mouth black bass.			279
		Warmouth bass			200
		Crappie			36
		Bream			
Clackamas, Oregon City, Oreg.[a]	Entire year	Chinook salmon		2,650,000	
		Lake trout			5,000
		Brook trout		51,000	582
		Rainbow trout		42,000	440
		Blackspotted trout		79,700	
Big White Salmon, Wash.	Aug. 1–Feb. 1	Steelhead trout	150,000	26,640	
		Chinook salmon	2,450,000	2,169,000	
Eagle Creek, Clackamas River, Oreg.	*Mar. 15–June 1*	*Steelhead trout*			
Little White Salmon, Wash.	Aug. 1–Mar. 1	Chinook salmon	1,100,000	4,284,450	
Eagle and Tanner Creeks, Columbia River, Oreg.	*Aug. 1–Oct. 15*	*Chinook salmon*			
Rogue River, Oreg.	Entire year	Chinook salmon	1,661,390	5,892,104	
		Steelhead trout		105,300	
		Blackspotted trout		900	
Applegate Creek, Oreg.	*Feb. 1–Apr. 30*	*Steelhead trout*			
Willamette Falls, Oreg.	May 28–June 30	Shad		874,000	

[a]For convenience in handling, transfers of eggs and fish were made as follows:
Lone Pine to Bozeman, Leadville, and Manchester, 1,575 golden trout for brood stock.
Yreka to other stations, 282,000 rainbow trout eggs.
Birdsview to St. Johnsbury, 50,000 steelhead trout eggs.
Battery to Central Station, 2,500,000 white perch eggs.
Bozeman to Nashua, 50,000 grayling eggs.
Bryans Point to Central Station, 1,950,000 yellow perch eggs.
Clackamas to other stations, 50,000 steelhead trout eggs.

STATIONS OPERATED AND THE OUTPUT OF EACH—Continued.

Name and location.	Period of operation.	Species handled.	Eggs.	Fry.	Finger-lings, year-lings, and adults.
Cold Springs, Bullochville, Ga.	Entire year	Large-mouth black bass.			241,355
		Small-mouth black bass.			250
		Warmouth bass			270
		Bream			16,600
		Catfish			900
Craig Brook, East Orland, Me.	Entire year	Atlantic salmon		2,156,852	39,830
		Landlocked salmon			39,360
		Silver salmon			
		Humpback salmon			11,641
		Rainbow trout			
		Brook trout		250,000	116,870
		Scotch sea trout			
Upper Penobscot, Stacyville, Me.	Oct. 10–June 9	*Atlantic salmon*			
Duluth, Minn	Entire year	Lake trout		6,060,000	3,388,000
		Brook trout		60,000	122,000
		Steelhead trout		8,000	9,300
		Whitefish		17,400,000	
		Pike perch		800,000	
		Black bass			
Grand Portage, Minn.	*Oct. 25–Oct. 30*	*Lake trout*			
Isle Royale, Mich	*Oct. 25–Oct. 31*	*Lake trout*			
Keweenaw Point, Mich.	*Oct. 1–Oct. 30*	*Lake trout*			
Marquette, Mich	*Oct. 17–Nov. 5*	*Lake trout*			
Ontonagon, Mich	*Oct. 23–Nov. 3*	*Lake trout*			
Rossport, Ont	*Sept. 18–Oct. 7*	*Lake trout*			
Susie Island, Minn	*Oct. 23–Nov. 7*	*Lake trout*			
		Whitefish			
Edenton, N. C	Mar. 15–May 31	Shad	235,000	16,085,000	
Weldon, N. C	Apr. 26–May 31	Striped bass		3,680,000	
Erwin, Tenn	Entire year	Rainbow trout			704,590
		Brook trout			326,535
		Large-mouth black bass.		40,000	1,000
		Small-mouth black bass.		9,000	664
		Rock bass			200
		Bream			3,355
		Catfish			
		Yellow perch			2,000
Fish Hawk (steamer), St. Johns River, Fla	Jan. 11–Apr. 23	Shad		72,150	
Fish Lakes, D. C.[a]		Large-mouth black bass.			16,800
		Crappie			140
		Bream		4,600	33,370
		Catfish			250
Gloucester, Mass	Entire year	Cod		93,380,000	
		Pollock		81,277,000	
		Flatfish		104,390,000	
		Lobster		16,325,000	
Beverly, Mass	*Apr. 15–June 30*	*Lobster*			
Boston, Mass	*do*	*Lobster*			
Cohasset, Mass	*do*	*Lobster*			
Hull, Mass	*do*	*Lobster*			
Marblehead, Mass	*do*	*Lobster*			
Nahant, Mass	*do*	*Lobster*			
Nantucket, Mass	*do*	*Lobster*			
Plymouth, Mass	*Dec. 29–Jan. 29*	*Cod*			
Portsmouth, Mass	*Apr. 15–June 30*	*Lobster*			
Quincy, Mass	*do*	*Lobster*			
Rockport, Mass	*do*	*Lobster*			
Salt Island, Mass	*do*	*Lobster*			
Green Lake, Me.[b]	Entire year	Lake trout		96,012	
		Brook trout		989,192	
		Landlocked salmon	150,000	147,569	190,229
Branch Pond, Me	*Sept. 1–Nov. 29*	*Landlocked salmon*			
		Brook trout			
Grand Lake Stream, Me.	Entire year	*Landlocked salmon*			
		Brook trout			
Leadville, Colo.[b]	Entire year	Brook trout	480,000	1,360,000	734,836
		Rainbow trout	117,500	224,500	134,000

[a] This station ceased to operate in 1906, but the fish remaining in the ponds were not distributed until 1907, upon the final abandonment of the grounds.

[b] For convenience in hatching, transfers of eggs were made as follows:
Leadville to other stations, 400,000 blackspotted-trout eggs and 400,000 brook-trout eggs.
Green Lake to other stations, 100,000 landlocked salmon eggs.

STATIONS OPERATED AND THE OUTPUT OF EACH—Continued.

Name and location.	Period of operation.	Species handled.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Leadville, Colo—Con.	Entire year	Blackspotted trout	200,000	5,100,000	
		Landlocked salmon			14,500
		Whitefish		950,000	
Cheesman Lake, Colo.	*Apr. 5–June 5*	*Rainbow trout*			
Derrys Lake, Colo.	*Nov. 12–Nov. 19*	*Brook trout*			
Edith Lake, Colo.	*Oct. 16–Nov. 20*	*Brook trout*			
Eldora Lake, Colo.	*Oct. 25–Nov. 21*	*Brook trout*			
Engelbrechts Lake, Colo.	*Oct. 15–Nov. 12*	*Brook trout*			
Grand Lake, Colo.	*Aug. 5–Aug. 30*	*Blackspotted trout*			
Grand Mesa Lakes, Colo.	*July 1–Aug. 10 and June 11–June 30.*	*Blackspotted trout*			
Musgroves Lake, Colo.	*Oct. 20–Nov. 28*	*Brook trout*			
Ridgways Lake, Colo.	*Nov. 15–Dec. 4*	*Brook trout*			
Smiths Lake, Colo.	*Nov. 9–Nov. 15*	*Brook trout*			
Twin Lakes, Colo.	*Oct. 10–Nov. 9*	*Brook trout*			
Wellington Lake, Colo.	*Oct. 5–Nov 30*	*Brook trout*			
Zoebles Lake, Colo.	*Oct. 20–Nov. 30*	*Brook trout*			
Mammoth Spring, Ark.	Entire year	Rainbow trout			6,000
		Large-mouth black bass.			2,100
		Small-mouth black bass.			75
Manchester, Iowa[a]	Entire year	Brook trout			511,525
		Rainbow trout	477,000		636,040
		Blackspotted trout		18,000	7,500
		Lake trout			
		Steelhead trout			
		Loch Leven trout			
		Golden trout			
		Grayling			
		Pike perch		1,000,000	
		Rock bass			11,250
		Large-mouth black bass.			
		Small-mouth black bass.			3,115
La Crosse, Wis.[b]	*July 1–Nov. 1*	Large-mouth black bass.			58,000
		Catfish			111,050
		Crappie			8,000
		Yellow perch			2,770
		Bream			5,000
		Pike			8,000
		Rock bass			3,000
North McGregor, Iowa.[c]	*July 1–Nov. 1*	Large-mouth black bass.			14,800
		Catfish			50,790
		Crappie			8,140
		Yellow perch			400
		Bream			2,730
		Pike			
		Rock bass			
Nashua, N. H	Entire year	Brook trout	55,737	286,000	15,100
		Rainbow trout		6,000	
		Lake trout		189,370	600
		Sunapee trout		213,163	
		Hybrid trout			
		Landlocked salmon		16,071	5,635
		Grayling		40,000	
		Large-mouth black bass.		855	
		Small-mouth black bass.		9,100	
Cumberland Center, Me.	Oct. 19–June 4	*Brook trout*			
Lake Sunapee, N. H.	*Sept. 17–Nov. 24*	*Brook trout*			
		Sunapee trout			
		Landlocked salmon			

[a] Transferred to other stations, 542,800 rainbow trout eggs.
[b] The work at this station consisted entirely of rescuing fishes from overflowed lands.
[c] See preceding footnote. The absence of figures in the output columns in this case indicates that the fish taken were transferred to the hatchery at Manchester.

STATIONS OPERATED AND THE OUTPUT OF EACH—Continued.

Name and location.	Period of operation.	Species handled.	Eggs.	Fry.	Finger-lings, year-lings, and adults.
Neosho, Mo.[a]	Entire year	Rainbow trout			153,100
		Large-mouth black bass.			38,045
		Small-mouth black bass.			25
		Rock bass			9,240
		Strawberry bass			8,382
		Bream			4,635
		Catfish			1,162
		Pike perch		1,300,000	
Northville, Mich.[a]	Entire year	Lake trout	23,020,000	6,000	
		Brook trout		568,000	2,500
		Rainbow trout			13,000
		Loch Leven trout			
		Pike perch			
		Small-mouth black bass.			22,931
Algonac, Mich	*May 18–May 30*	*Pike perch*			
Alpena, Mich	Feb. 26–May 11	Lake trout		5,000,000	
		Whitefish		20,000,000	
Bay City, Mich	*Apr. 1–May 1*	*Pike perch*			
Beaver Island, Mich	*Oct. 26–Dec. 15*	*Lake trout*			
		Whitefish			
Belle Isle, Mich	*Oct. 25–Dec. 8*	*Whitefish*			
Charlevoix, Mich	Mar. 1–Apr. 27	Lake trout		5,000,000	
		Whitefish		20,000,000	
Detroit, Mich.[a]	Entire year	Whitefish	32,650,000	27,000,000	
		Pike perch	50,000,000	23,500,000	
Grassy Island, Mich	*Oct. 22–Dec. 7*	*Whitefish*			
Sault Ste. Marie, Mich	Mar. 10–June 13	Lake trout	500,000	5,650,000	
		Whitefish		23,900,000	
Put-in Bay, Ohio [a]	Entire year	Whitefish	57,249,000	87,500,000	
		Pike perch	204,150,000	229,000,000	
		Lake herring	9,040,000	50,000,000	
		Lake trout		900,000	
Kelleys Island, Ohio	*Nov. 13–Nov. 30*	*Whitefish*			
		Lake herring			
Monroe Piers, Mich	*Oct. 22–Nov. 22 and Apr. 1–Apr. 26.*	*Whitefish*			
		Pike perch			
North Bass, Ohio	*Nov. 13–Nov. 30*	*Whitefish*			
		Lake herring			
Pelee Island, Ont	*Nov. 16–Nov. 28*	*Whitefish*			
		Lake herring			
Port Clinton, Ohio	*Nov. 1–Dec. 3 and Apr. 1–May 1.*	*Whitefish*			
		Lake herring			
		Pike perch			
Toledo, Ohio	*Apr. 1–May 3*	*Pike perch*			
Quincy, Ill	Entire year	(Office headquarters).			
Meredosia, Ill.[b]	*July 1–Nov. 30 and May 1–June 30.*	Large-mouth black bass.			22,230
		Catfish			2,800
		Yellow perch			10,125
		Pike perch		12,250,000	
St. Johnsbury, Vt.[a]	Entire year	Brook trout	110,000	884,346	
		Lake trout		180,650	
		Steelhead trout		38,529	
		Landlocked salmon		28,096	
		Small-mouth black bass.		46,500	250
		Yellow perch		600,000	
Arlington, Vt	Nov. 15–June 30	*Brook trout*			
Darling Pond, Groton, Vt.	*Sept. 11–Dec. 25*	*Brook trout*			
Lake Mansfield, Stowe, Vt.	*Sept. 18–Dec. 31*	*Brook trout*			
Lake Mitchell, Sharon, Vt.	*Sept. 1–Dec. 21*	*Brook trout*			
Pittsford, Vt	July 1–Oct. 20	Brook trout			81,612
Swanton, Vt.[b]	Mar. 1–May 26	Pike perch	3,000,000	84,000,000	
		Yellow perch		9,200,000	

[a] For convenience in hatching, transfers were made as follows:
Neosho to other stations, 142,000 rainbow-trout eggs; 9,775 of the large-mouth black bass and 1,900 of the crappie distributed from Neosho were purchased at Langdon, Kans.
Northville to other stations, 26,398,000 lake-trout eggs and 4,500,000 pike-perch eggs
Detroit to other stations, 116,500,000 whitefish eggs and 10,000,000 pike-perch eggs.
Put-in Bay to other stations, 65,250,000 pike-perch eggs.
St. Johnsbury to other stations, 106,000 brook trout eggs; and for rearing to the fingerling stage 125,000 brook trout fry to Arlington and 50,000 to Nashua.
Swanton to other stations, 18,500,000 pike perch eggs and 2,400,000 yellow perch eggs.
[b] Station for collection of fishes from overflowed lands.

STATIONS OPERATED AND THE OUTPUT OF EACH—Continued.

Name and location.	Period of operation.	Species handled.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
San Marcos, Tex	Entire year	Large-mouth black bass			66,977
		Rock bass			3,812
		Warmouth bass			1,390
		Crappie			695
		Bream			3,585
		Catfish			2,025
Spearfish, S. Dak.[a]	Entire year	Brook trout			661,100
		Blackspotted trout	290,000	215,000	550,150
		Rainbow trout			60,000
		Loch Leven trout			67,000
West Thumb, Yellowstone Park.	May–August	*Blackspotted trout*			
Tupelo, Miss	Entire year	Large-mouth black bass.			5,814
		Crappie		700	500
		Bream		1,300	630
White Sulphur Springs, W. Va.	Entire year	Large-mouth black bass.		5,000	
		Small-mouth black bass.		78,000	560
		Brook trout	500		555,450
		Rainbow trout			118,750
		Blackspotted trout			5,800
Lake Toxaway, N. C.	*Oct. 3–Nov. 6 and Feb. 3–Mar. 10.*	*Brook trout*			
		Rainbow trout			
Woods Hole, Mass	Entire year	Cod		113,867,000	
		Flatfish		74,235,000	
		Haddock		2,499,000	
		Pollock		5,022,000	
		Tautog		450,000	
		Lobster		14,084,000	844
East Greenwich, R. I.	*Mar. 15–Apr. 13*	*Flatfish*			
Plymouth, Mass	*Nov. 20–Apr. 2*	*Cod*			
		Haddock			
		Pollock			
Waquoit, Mass	*Mar. 21–Apr. 11*	*Flatfish*			
Wytheville, Va.[a]	Entire year	Large-mouth black bass.			12,725
		Rock bass		6,750	2,900
		Rainbow trout	5,000		249,657
		Steelhead trout			418
		Brook trout			224,600
Yes Bay, Alaska	Entire year	Blueback salmon		54,610,800	
		Steelhead trout		143,500	

[a] For convenience in hatching, transfers of eggs were made as follows:
Spearfish to other stations, 730,000 blackspotted-trout eggs.
Wytheville to other stations, 414,500 rainbow-trout eggs.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1907.

CATFISH.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Arizona:	
Fort Thomas, Indian Hot Springs Lake	100
Hereford, Stuart's reservoir	100
White's reservoir	100
Patagonia, Crepin's pond	300
Williams, Allen's lake	300
Colorado:	
La Veta, J. F. Hay's pond	200
R. A. Hay's pond	200
Willis's lake	200
Palisades, Saunder's pond	125
Placerville, Blue Lake	200
Frisco Lake	125
Connecticut:	
Meriden, Black Pond	140
Georgia:	
Crawfordville, Chapman's pond	112
Ellington's pond	112
Georgia—Continued.	
Crawfordville, Little River	112
North Little River	116
Stephens Creek Pond	224
Conyers, Hicks's pond	112
Thomson, Sills Creek Pond	112
Illinois:	
Antioch, Petite Lake	275
Cameron, Nelson's pond	200
Deer Creek, Dehr's pond	125
Elburn, Gray's pond	200
Freeport, Pecatonica River	200
Marengo, Metcalf's pond	400
Naperville, Quarry Pond	400
Oneida, Thayer's lake	400
Riverside, Walker's pond	400
Woodhull, Lowry's pond	200

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

CATFISH—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Indiana:	
Albion, Deep Lake	300
Liberty Mills, Eel River	300
Pierceton, Webster Lake	300
Pleasant Lake, Reed Lake	200
Iowa:	
North McGregor, Mississippi River	45,000
Kansas:	
Blaine, Mourke's pond	150
Garnett, South Fork Creek	50
Hill City, Rice's pond	100
Colton, Hockmuth's pond	100
Leoti, Bluff Pond	200
Duck Pond	200
Johnston's pond	200
Lyndon, Yates Pond	125
Menlo, Commin's pond	100
Merriam, Householder Pond	100
Pierceville, Douglas Pond	100
Summerfield, Glick's pond	150
Wakenney, Big Creek Pond	100
Maryland:	
Baltimore, Windy Edge Pond	100
Massachusetts:	
Leominster, Brookside Pond	100
Michigan:	
Clare, Dailey Lake	100
Fin Lake	100
Lake Arnold	100
Tobacco River	100
Niles, Detter's pond	200
Minnesota:	
St. Paul, Minnesota Fish Commission	7,200
Missouri:	
Brookland, Wood Pond	150
Mayview, Chestnut Grove Pond	100
Monet, Thomas Pond	100
Neosho, Hickory Creek	912
New Mexico:	
Ancho, Cooper's pond	100
French's pond	100
Carrizozo, Paden's pond	200
Taylor's pond	100
Corona, Bonito Canyon Pond	100
Folsom, Mountain View Reservoir	100
Fort Bayard, irrigating pond	100
Separ, Baker's lake	100
Servilleta, Rio Grande	300
North Dakota:	
Brocket, Shoe Lake	400
Devils Lake, Devils Lake	300
Fullerton, artesian pond	225
Ohio:	
Cambridge, Gillespie's pond	100
Hubbard, ice pond	150
Latty, Latty Pond	100
Pennsylvania:	
Arcola, Perkiomen Creek	100
Pennsylvania—Continued.	
Collegeville, Skippack Creek	100
Rahms, Perkiomen Creek	100
Scranton, Moosic Creek	250
Texas:	
Athens, Spring Pond	12
Big Springs, Mouldin Pond	82
Bonham, Luckett Pool	20
Grady, Morris's pond	10
Campbell, Campbell Pond	120
Celeste, Eldridge's pond	10
Clarendon, Bitter Lake	60
Dahlhart, Williams's pond	10
Dallas, Ware's lake	40
Devine, Johnson's pond	40
Franklin, Orchard Pond	30
Garland, Alexander Park Lake	10
Graham, Cherryhomes's pond	70
Greenville, Crush Lake	100
Henderson, Willow Lake	75
Hereford, Arnold's pond	35
Carr's pond	35
Terra Blanco Creek	175
Higgins, Myers's pond	10
Hillsboro, Carter's pond	30
Hubbard, Allen's pond	20
Farm Pond	20
Marshall, Katrine Pond	50
Midland, Rankin's pond	20
Salt Lake	104
Odessa, Barron's pond	10
Roscoe, Settle's pond	16
San Antonio, Brown's lake	30
Davis's artificial lake	10
Martin's lake	20
Sharpe's lake	30
Seguin, Guadalupe River	50
Sunset, Long's pond	10
Sweetwater, Boatright's pond	10
Vernon, Sherwood Pond	40
Waxahachie, Pierce's lake	40
Weatherford, Rod and Gun Club Lake	130
West, Duffel's reservoir	20
Whitesboro, artificial lake	100
Choice's pond	30
Sanborn Pond	40
Winnsboro, Carloch's lake	50
Green's pond	40
Hurdle's lake	75
King's pond	10
Moore's pond	75
Wisconsin:	
La Crosse, Mississippi River	100,000
Mauston, Bush Creek	300
Wyoming:	
Green River, Green River	250
Total [a]	168,426

[a] 551 fingerlings were lost in transit.

SHAD.

State, locality, and disposition.	Eggs.	Fry.
Florida:		
Fort Gates, St. Johns River		72,150
Maryland:		
Battery Station, Chesapeake Bay		3,927,000
Maryland—Continued.		
Bryans Point, Potomac River		1,989,000
Eastern Flats, Chesapeake Bay		6,005,000

Details of Distribution of Fish and Eggs—Continued.

SHAD—Continued.

State, locality, and disposition.	Eggs.	Fry.	State, locality, and disposition.	Eggs.	Fry.
Maryland—Continued.			North Carolina—Continued.		
Havre de Grace, Chesapeake Bay		3,000,000	Plymouth, Roanoke River		549,000
Havre de Grace, Susquehanna River		500,000	Plymouth, Swan Bay		555,000
Potomac River, Accokeek Creek		2,340,000	Oregon:		
Potomac River, Broad Run		4,729,000	Clackamas, Willamette River		274,000
Potomac River, Pamunkey Creek		3,040,000	Virginia:		
Potomac River, Piscataway Creek		3,404,000	Courtland, Nottoway River		800,000
Potomac River, Swan Creek		1,723,000	Jamestown, Jamestown Exposition	400,000	
Western Flats, Chesapeake Bay		5,342,000	Occoquan, Occoquan Bay		3,040,000
North Carolina:			Potomac River, Dogue Creek		3,250,000
Avoca, Salmon Creek	150,000	3,050,000	Potomac River, Litte Hunting Creek		7,363,000
Capeharts Shore, Albemarle Sound		1,341,000	Potomac River, Pohick Creek		3,989,000
Edenton, Albemarle Sound		2,239,000	Suffoik, Nansemond River		300,000
Edenton, Chowan River		4,799,000	Washington:		
Edenton Bay		831,000	Snohomish, Snohomish River		297,000
Reedy Marsh		846,000	Whatcom County, Skagit River		300,000
Roanoke River		700,000			
Plymouth, Albemarle Sound	85,000		Total [a]	635,000	70,594,150

[a] 78,000 fry were lost in transit.

WHITEFISH.

State, locality, and disposition.	Eggs.	Fry.	State, locality, and disposition.	Eggs.	Fry.
Colorado:			New York:		
Buffalo Creek, Lake Cheesman		920,000	New York City, New York Aquarium	10,000	
Twin Lakes, Twin Lakes		30,000	Cooperstown, Otsego Lake		468,000
Michigan:			Constantia, New York Fish Commission	5,000,000	
Belle Isle, Detroit River		27,000,000	Grenadier Island, Lake Ontario		19,000,000
Charlevoix, Lake Michigan		11,000,000	Wilsons Bay, Lake Ontario		7,000,000
Charlevoix, Pine Lake		7,000,000	Wolfe Island, Lake Ontario		3,000,000
Detour, Lake Huron		8,000,000	Ohio:		
Detroit, Detroit Aquarium	640,000		Catawba Island, Lake Erie		10,000,000
Fishermans Home, Lake Superior		2,800,000	Isle St. George, Lake Erie		10,000,000
Grace Harbor, Lake Superior		2,800,000	Kelleys Island, Lake Erie		10,000,000
Irishmans Reef, Lake Michigan		2,000,000	Lakeside, Lake Erie		10,000,000
Manistique, Lake Michigan		2,900,000	Middle Bass Island, Lake Erie		10,000,000
Marquette, Lake Superior		4,200,000	Port Clinton, Lake Erie		10,000,000
Minden City, Lake Huron		4,000,000	Put-in Bay, Lake Erie		27,500,000
North Point, Lake Huron		8,000,000	Pennsylvania:		
Ontonagon, Lake Superior		2,800,000	Erie, Pennsylvania Fish Commission	57,249,000	
Point Iroquois, Lake Superior		4,000,000	Wisconsin:		
Sault Ste. Marie, Lake George		3,000,000	Aminicon River, Lake Superior		2,400,000
Scarecrow Island, Lake Huron		8,000,000	Oshkosh, Wisconsin Fish Commission	25,000,000	
Whitefish Point, Lake Superior		6,000,000	New Zealand:		
Minnesota:			Wellington, New Zealand government	2,000,000	
Duluth, Lake Superior		2,400,000	Total	89,899,000	226,218,000

Details of Distribution of Fish and Eggs—Continued.

LAKE CISCO.

State, locality, and disposition.	Eggs.	Fry.
Ohio:		
Catawba Island, Lake Erie		10,000,000
Isle St. George, Lake Erie		10,000,000
Kelleys Island, Lake Erie		10,000,000
Middle Bass Island, Lake Erie		10,000,000
Put-in Bay, Lake Erie		10,000,000
Pennsylvania:		
Erie, Pennsylvania Fish Commission	8,040,000	
New Zealand:		
Wellington, New Zealand government	1,000,000	
Total	9,040,000	50,000,000

CHINOOK SALMON.

State, locality, and disposition.	Eggs.	Fry.
California:		
Alton, California Fish Commission	7,768,900	
Baird, McCloud River		2,512,250
Brookdale, Santa Cruz County hatchery	1,400,000	
Sisson, California Fish Commission	63,671,415	
New Hampshire:		
Laconia, New Hampshire Fish Commission	36,000	
Oregon:		
Clackamas, Clackamas River		2,038,000
Clackamas, Spring Branch		612,000
Ontario, Oregon Fish Commission	3,550,000	
Rogue River station, Elk Creek		1,375,000
Rogue River station, Rogue River		4,517,104
Oregon—Continued.		
Viento, Columbia River		2,350,000
Wedderburn, applicant	1,661,390	
Washington:		
Baker Lake station, Baker Lake		5,000
Baker Lake station, Lower Baker River		7,848
Big White Salmon station, Columbia River		1,669,000
Big White Salmon station, Olsen Creek		500,000
Birdsview, Granby Creek		46,440
Little White Salmon station, Little White Salmon River		1,934,450
New Zealand:		
Wellington, New Zealand government	500,000	
Total	78,587,705	17,567,092

SILVER SALMON.

State, locality, and disposition.	Eggs.	Fry.
California:		
Brookdale, Santa Cruz County hatchery	100,000	
Michigan:		
Detroit, Belle Isle aquarium	10,000	
New Hampshire:		
Laconia, New Hampshire Fish Commission	50,000	
Washington:		
Baker Lake station, Baker Lake		260,000
Washington—Continued.		
Baker Lake station, Baker River		60,000
Baker Lake station, Lower Baker River		678,352
Birdsview, Grandy Creek		2,493,600
Birdsview, Phinney Creek		145,000
Total	160,000	3,636,952

BLUEBACK SALMON.

State, locality, and disposition.	Eggs.	Fry.
Alaska:		
Yes Bay, Yes Lake		12,038,000
Yes Bay, Yes Lake and River		22,480,500
Yes Bay, Yes River		20,092,300
Washington:		
Baker Lake station, Baker Lake		140,000
Washington—Continued.		
Baker Lake station, Baker River		250,000
Baker Lake station, Lower Baker River		3,834,255
Total		58,835,055

HUMPBACK SALMON.

State, locality, and disposition.	Fingerlings.
Maine:	
Bucksport, Dead Brook	600
East Orland, Allamoosook Lake	8,519
East Orland, Craig Brook	1,284
Maine—Continued.	
East Orland, Heart Pond	1,238
Total	11,641

Details of Distribution of Fish and Eggs—Continued.

STEELHEAD TROUT.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Alaska:			
Yes Bay, Yes Lake		143,500	
Idaho:			
Coeur d'Alene, Coeur d'Alene Lake			6,500
Maine:			
Newcastle, Viscay Pond		7,500	
Pemaquid Pond		7,500	
Michigan:			
Detroit, Belle Isle Aquarium	10,000		
Munissing, Cleveland Cliffs Iron Company	50,000		
Minnesota:			
Duluth, Lester River			6,300
St. Louis County, French River		8,000	
Montana:			
Bozeman, Mystic Lake			20,000
Gallatin County, East Gallatin River			10,000
Norris, Lake Madison			35,000
North Dakota:			
St. John, Jarvis Lake			1,000
Oregon:			
Clackamas, Clackamas River		26,640	
Rogue River station, Elk Creek		5,300	
Rogue River		100,000	
Vermont:			
Newport, Clyde River		11,229	
West Danville, Joes Pond		11,300	
Virginia:			
Wytheville, Reed Creek			418
Washington:			
Birdsview, Grandy Creek		874,865	
Hamilton, Hermits Lake		40,000	
Wisconsin:			
Gordon, applicant	20,000		
Wyoming:			
Sheridan, applicant	10,000		
Wyoming Fish Commission	50,000		
France:			
Bellefontaine, French Government	10,000		
Total[a]	150,000	1,236,834	79,218

[a] 1,000 fry and 2,000 fingerlings were lost in transit.

RAINBOW TROUT.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Alabama:			
Bessemer, Hawkins Spring			1,000
Childersburg, Talladega Creek			9,500
Arizona:			
Flagstaff, Live Oak Creek			800
North Oak Creek			1,200
Jerome Junction, Oak Creek			1,000
Patagonia, Temporal Creek			1,000
Arkansas:			
Cotter, North Fork of White River			10,000
Mammoth Springs, Spring River			6,000
Monte Ne, Monte Ne Lake			10,000
Rogers, Cloverdale Lake			1,200
Sulphur Springs, Butler Creek			9,000
La Balladine Lake			15,000
Colorado:			
Allenton, Eagle River		7,500	
Aspen, Maroon Lake		10,000	
Roaring Fork River		20,000	
Snow Mass Lake		15,000	
Willow Lake		15,000	
De Beque, Plateau and Leon Creeks		7,500	
Del Norte, Rio Grande			2,500
Denver, South Fork of Rio Grande			10,000
Eldora, Lake Eldora			10,000
Fort Collins, Rocky Ridge Lake			10,000
Georgetown, Naylor Lake			10,000
Glenwood Springs, Mitchell Creek		12,500	
Hartsel, South Fork of Platte River		15,000	
Iola, Gunnison River			10,000
Lyons, St. Vrain River			12,500
Marshall, South Boulder Creek			15,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults
Colorado—Continued.			
Minturn, Echo Lake		25,000	2,000
Palo, Higgins Reservoir			3,000
Paonia, Balch's pond			5,000
Rifle, Rifle Creek			4,000
Salida, Ridgeway Ponds		2,000	
South Arkansas River			10,000
Thomasville, Frying Pan River			16,000
Twin Lakes, Twin Lakes		25,000	
Georgia:			
Cornelia, Little Mud Creek			1,000
Marietta, Toy Creek			1,200
Idaho:			
Alexander, Bear River			3,000
Hailey, Silver Creek			2,000
Wood River			3,000
Mackay, Big Lost River			3,000
Montpelier, Grove Lake			1,800
Pebble, Portneuf River			2,500
Post Falls, Spokane River			3,000
St. Anthony, John Creek Pond			1,000
Paradise Pond			2,000
Silver Springs, Harris Springs			1,600
Soda Spring, Whiskey Creek			1,000
Sugar, Warm Creek			1,500
Indian Territory:			
Ardmore, Brown's pond			400
Tanner's Mill Pond			1,000
Iowa:			
Charles City, Cedar River			39,000
Chester, South Branch of Beaver Creek			2,000
Cresco, Baldwin Creek			12,000
Turkey River			27,000
Decorah, Canoe Creek			9,000
Trout Run			21,000
Twin Springs			9,000
Walnut Creek			12,000
Ionia, Wapsipinicon River			39,000
McGregor, Upper Sny Magill Creek			12,000
Manchester, Maquoketa River			575
Spring Branch			17,205
North McGregor, Bloody Run			32,000
Nora Springs, Shell Rock River			39,000
Waukon, North Fork of Yellow River			12,000
Paint and Silver creeks			12,000
Patterson Creek			15,000
Village Creek			12,000
Kentucky:			
Ryland, Fishing and Shooting Club ponds			1,000
Maryland:			
Baltimore, Maryland Fish Commission	100,000		
Bel Air, Rock Spring			400
Boyd, Little Seneca River			1,200
Cumberland, Clarks Brook			800
Garret and Washington counties, Maryland Fish Commission		18,450	
Glyndon, Lake Dorosa			500
Waterspout Creek			500
Laurel, Lake Macoe			900
Monkton, Charles Run			1,400
Sandy Springs, Maryland Fish Commission			3,000
Owing Mills, Red Run			800
Massachusetts:			
East Freetown, applicant	30,000		
Wilkinsonville, Massachusetts Fish Commission	50,000		
Michigan:			
Alanson, Cedar Brook			1,500
Crystal Falls, Paint River			2,500
Dowagiac, Big Dowagiac Creek			3,000
Houghton, Firesteel River			10,000
Roscommon, Barnes Creek			2,000
Wingleton, Baldwin Creek			1,000
Pere Marquette River			9,200
Missouri:			
Arlington, Big Piney River			8,000
White Mule Slough			3,000
Bethpage, Elkhorn Pond			500
Bourbon, Blue Spring			2,000
Brookline, McLaughlin's lake			500
Club House, Currant River tributary			9,000

Details of Distribution of Fish and Eggs—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Missouri—Continued.			
Crane, Crane Creek			5,500
Spring Creek			5,000
Monet, Big Flat Creek			1,200
Neosho, Hickory Creek			4,500
McMahans Spring			8,000
Newberg, Little Piney Creek			300
Meramec River			2,000
Noel, White Spring Creek			10,000
Saint James, Little Piney Creek			2,000
Meramec Springs			4,000
Schlicht, Schlicht Springs			4,000
Seneca, Little Sycamore Creek			3,000
Sullivan, Reese's lake			8,000
Summerfield, Paydown Creek			10,000
Verona, Head of Spring River			5,500
Warsaw, Deer Creek			10,000
Montana:			
Anaconda, Seymour Creek			2,000
Bozeman, McDonnell's pond			3,000
Mitchell's pond			1,000
Ross Creek			15,000
Columbia Falls, Flathead River			3,000
Dillon, Ashbaughs Creek			1,500
Emmerick Creek			1,000
Little Flat-tail Deer Creek			1,500
Minneopa Lake			2,000
Orrs Creek			1,000
Van Camps Creek			1,500
Harlowton, Carless Creek			2,000
Lewistown, Brownley's pond			500
Jones' pond			800
South Fork of McDonald Creek			2,700
Moore, Crystal Springs Pond			1,000
Norris, Meadow Creek Lake			15,000
Stryker, Tobacco River			2,500
Nebraska:			
Chadron, Chadron Creek			9,700
South Bend, Nebraska Fish Commission	97,000		1,000
New Hampshire:			
Enfield, Johnson's pond			360
Keene, Ashuelot River		6,000	
Warren, Baker's river			540
New Mexico:			
Espinola, Rio Puerco Creek			5,200
Santa Clara Creek			5,500
Glorieta, Mora Creek			3,000
Pecos River			2,700
Serviletta, Rio don Fernandez			7,500
New York:			
New York City, New York Aquarium	5,000		
North Carolina:			
Andrews, Friers Creek			1,000
Junaluska River			1,000
Nantahalah River			3,600
Asheville, Bull Cove Branch			600
Bull Creek			9,600
Lake Burrowes			2,000
Laurel Fork Creek			1,600
Moody Branch			1,600
Reems Creek			7,400
South Fork of Ox Creek			1,600
Bear Creek, Phillip's pond			4,300
Bryson City, Alarka Creek			1,500
Bridge Creek			600
Cherry Creek			800
Coopers Creek			1,000
Deep Creek			7,200
Galbreath Creek			600
Indian Creek			2,000
Korklands Creek			600
Lands Creek			1,000
Nettle Creek			1,000
Pole Road Creek			1,800
West Branch of Deep Creek			800
Bushnell, Chambers Creek			1,200
Conway, Banks Hill Run			250
Cranberry, Blevins Creek			500
Dillsboro, Bakers Creek			400
Savannah Creek			1,500

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.			
Fletchers, Cane Creek			2,000
Goldsboro, Dortch's pond			3,000
Granville County, Spring Pond			4,000
Graphiteville, Mill Creek			8,700
Greensboro, Ash Pond			400
Maria Branch Pond			2,400
Hendersonville, Becks Creek			1,000
Green River			2,000
Murrah Creek			800
Highland, Cullasaja Creek			7,000
Judson, Painter Creek			800
Lake Toxaway, Deep Ford Creek			3,000
Lake Fairfield			14,700
Lake Toxaway			14,600
Mill Creek			3,000
Sapphire Lake			1,600
Toxaway River			2,500
Marion, Armstrong Creek			800
Bald Creek			350
Beaverdam Creek			800
Bee Rock Creek			500
Big Buck Creek			600
Cedar Cove Creek			400
Clear Creek			1,200
Coxes Creek			800
Devils Fork Creek			700
Dobsons Creek			900
Duncan Cove Creek			750
Dysart Creek			750
Fall Creek			12,500
Glade Creek			900
Goforth Creek			1,200
Gordon Creek			300
Honeycut Creek			400
Jones Creek			900
Licklog Creek			800
Limekiln Creek			850
Lost Cave Creek			800
Matthis Creek			750
Moses Creek			4,000
Mount Creek			1,000
Noblitts Creek			700
North Fork Creek			800
Oil Mill Creek			350
Peppers Creek			800
Pools Creek			700
Reedy Fork Creek			800
Roaring Fork Creek			450
Sams Creek			600
Shadricks Creek			750
Simmons Creek			700
Sowers Creek			400
Spring Creek			400
Still House Branch			400
Thompsons Fork Creek			800
Three Mile Creek			12,500
Toms Creek			500
Turkey Cove Creek			750
Vess Mill Creek			750
Walnut Creek			750
York Creek			400
Mitchell County, Linville River			300
Morganton, Rose Creek			3,000
Steeles Creek			16,000
Upper Creek			3,000
Mount Sterling, East Fork of Big Creek			950
West Fork of Big Creek			950
Murphy, Fires Creek			800
Hiawassee River			26,500
Shearer Mill Creek			1,200
Tusquittee Creek			800
Nantahalah, Nantahalah River			1,000
Old Fort, Catawba River			1,500
Mill Creek			1,050
Osgood, Yarborough's pond			200
Polkton, Lanes Creek			1,200
Quebec, Flat Creek			2,400
Raleigh, Lucerne Pond			300
Rosmon, East Fork Creek			1,005

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.			
Rosmon, Middle Fork of French Broad River			3,000
North Fork of French Broad River			3,000
Rutherfordton, Cove Creek			970
Saluda, Camp Creek			2,000
Cove Creek			2,000
Scaly, Middle Creek			6,500
Shelby, Cascade Branch Pond			1,000
Spray, Silver Lake			3,000
Spruce Pine, Brush Lake			10,000
Grassy Creek			10,000
Thermal City, Stony Creek			485
Tryon, North Pacolet Creek			2,800
Pacolet River			2,750
Vaughns Creek			2,700
Waynesville, Big Spring Branch			1,500
Brenble Creek			1,500
Dicks Creek			600
Racky Creek			1,200
Richland Creek			1,500
tributaries of Raccoon Creek			600
True Love Creek			500
Whittier, Oconalufty River			1,500
Winston Salem, Byerlys Creek			500
Zirconia, Green River			10,000
North Dakota:			
Mercer, Brush Lake			500
St. John, Long Lake			500
Ohio:			
Tennison, Gatchel's pond			1,000
Miller, Cove Spring Pond			1,500
Warwick, Chidester's pond			1,000
Oregon:			
Astoria, Youngs River		10,000	
Gaston, Tualitin River		8,000	
Hood River, Hood River		5,000	
La Grande, Five Points Creek		5,900	
Ladd Creek		3,000	
Mill Creek		6,000	
Pennsylvania:			
Bear Creek, Lehigh River			2,100
Tobyhanna Creek			2,100
Blossburg, Brandy Run			500
Cold Run			500
Dibble Creek			500
Dykes Creek			1,000
Fellows Creek			1,000
Mill Run			500
Morris Run			500
Sand Run			1,000
Tioga River			1,000
Buena Vista Spring, Cascade Creek			1,000
Cammal, Blows Run			500
Miller Run			1,500
Otter Run			1,000
Trout Run			1,000
Truman Run			500
Wolfe Run			500
Chambersburg, Falling Spring			1,500
Fox Run			500
Raccoon Run			1,000
Clearfield, Little Montgomery Creek			1,500
Montgomery Creek			1,500
Cogan Valley, Hogland Run			1,000
Corry, Pennsylvania Fish Commission	100,000		
Coudersport, Cushing Creek			2,000
Dingleman Run			2,000
Mill Creek			2,000
Moores Run			2,000
Upper Allegheny River			2,000
Cresco, Bushkill Creek			2,100
Driftwood, Jerry Run			1,500
Mix Run			2,000
Wykoff Run			2,000
Galeton, South Branch			4,500
Henryville, Broadheads Creek			2,100
Paradise Creek			2,100
West Branch of Broadheads Creek			2,800
Hollidaysburg, Beaverdam Creek			1,000
Huntingdon, Standing Stone Creek			3,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Jamison City, Grassy Hollow Creek			700
Long Run			700
Quinn Branch			700
West Branch of Fishing Creek			1,400
Lewisburg, Rapid Run			2,100
Mahanoy City, Coal Run			500
Messer Run			400
Water Dam Pond			300
Montoursville, Mill Creek			1,200
Nordmont, Dutchmans Run			1,000
East Branch of Muncy Creek			1,000
Pauls Run			1,000
Muncy Creek			1,500
Tublic Run			1,000
Pottsville, Tars Run			1,000
Reading, Spring Creek			400
Rising Springs, Penns Creek			4,000
Wernersville, Little Cacoosing Creek			400
Williamsburg, Clover Creek			1,000
Upper Clover Creek			1,000
Windber, Big Paint Creek			2,000
Clear Shade Creek			2,000
Dark Shade Creek			2,000
Laurel Run			1,000
Little Paint Creek			2,000
Piney Run			1,000
Roaring Fork Creek			1,500
South Carolina:			
Gaffney, Limestone Creek			7,000
Pickens, North Saluda River			5,500
South Dakota:			
Cascade Springs, Cascade Creek			10,000
Elmore, Spearfish Creek			30,000
Spearfish, Johnson's lake			10,000
Tennessee:			
Bluffton, Indian Camp Creek			1,200
Butler, Holly Spring Lake			1,200
Campbell Junction, Railroad Lake			1,200
Crosby, Livingston's lake			2,000
Doeville, Doe Creek			9,400
Fishery, Spring Branch			185
Greenback, Citico Creek			15,000
Hampton, Doe River			375
Little Doe River			300
Laurel Fork			375
Lower Doe Creek			450
Lower Laurel Fork Creek			300
Hartford, Indian Camp Fork Creek			15,000
Pigeon Creek			7,500
Hunters, Stony Creek			1,200
Jackson, Crystal Lake			3,000
Johnson City, Jobes Big Spring			4,000
Limestone, Big Limestone Creek			3,000
Jockey Creek			2,000
Loves Station, South Indian Creek			30,000
Maryville, Limestone Lake			3,000
Newport, Clear Creek			9,000
Roan Mountain, Doe River			1,500
Shouns, Roans Creek			10,000
Sparta, Dibrell's pond			1,700
Tazewell, Parker Pond			2,000
Tracy City, East Fork of Collins River			1,500
Unaka Springs, Nolichucky River			70,000
Unicoi, Blue Springs			1,000
Unicoi County, Martins Creek			30,000
North Indian Creek			45,000
Rock Creek			30,000
Washington County, Knob Creek			1,400
Wetmore, Williams Creek			10,000
Utah:			
Brigham City, applicant	10,000		
Ogden, Barker's spring		5,000	
Jensen's pond		5,000	
Rainbow Pond		5,000	
Spring Creek		15,000	
Stalling Spring		10,000	
Provo, Provo River		30,000	
Salt Lake City, applicant	100,000		

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Vermont:			
Proctor, Proctor's pond			900
Virginia:			
Abingdon, White Top Creek			5,000
Berryville, North Hill Pond			300
Chester, Osborn's pond			200
Covington, Gilliams Branch			15,000
Damascus, Laurel Creek			10,000
Fries, Peachbottom Creek			7,500
Galax, Chestnut Creek			10,000
Glen Wilton, Sullender's pond			5,000
Grottoes, Big Branch			1,000
Haymarket, Cattharpin Creek			1,500
Jamestown, Jamestown Exposition	20,000		
Maidens, Beautiful Creek Pond			200
Marion, Middle Fork of Holston River			15,000
North Fork of Holston River			10,000
Maxwell, Spring Pond			7,000
Natural Bridge, Cedar Creek			25,000
Paeonian Springs, Clear Creek		8,265	
Pleasant Valley, Pleasant Run			1,000
Purcellville, Purcellville Creek			1,000
Saltville, North Fork of Holston River			10,000
Red Creek			10,000
Tumbling Creek			10,000
Spencer, McBride's pond			1,000
Spring Creek, Briery Branch			1,000
Stephenson, Jordan Spring Creek			1,000
Taylors Valley, Branch of Laurel Creek			19,000
Valley Branch of Laurel Creek			10,000
Vancluse Station, Vancluse Creek			1,000
Wytheville, Cove Creek			10,000
Reed Creek			707
Washington:			
Grassmere, Hermits Lake		1,800	
Summer, Salmon Springs pond		2,000	
Tacoma, Rainbow Lake			440
West Virginia:			
Fishing Hawk, Cheat River			4,800
Glady, North Fork of Glady Creek			4,800
Harpers Ferry, Piney Creek			1,200
Inwood, Hollis's pond			1,200
Kingwood, Laurel Run			2,400
Martinsburg, Tomahawk Run			1,000
Ronceverte, Lake Pond			150
Seebert, Sugar Grove Pond			300
Webster Springs, Elk River			2,500
Weston, Fink Creek Pond			2,900
Leggett's pond			600
Williams, Sand Run Creek			3,800
Wisconsin:			
Alma Center, Cisney Creek			1,000
Arcadia, Bishop Creek			7,500
Eagles Valley Creek			6,000
Gilman Creek			2,000
Haines Creek			2,000
Holcomb Coulee Creek			6,000
Hunters Creek			6,000
Kried Valley Creek			2,000
Lewis Valley Creek			3,000
Long Creek			6,000
Montana Creek			6,000
Rocky Run			6,000
Sandy Creek			6,000
Willow Creek			1,500
Augusta, Bridge Creek			1,500
Blair, Tennison Creek			6,000
Vosse Coulee Creek			6,000
Edmund, Furnis Hollow Creek			1,500
Galesville, Corrigan			20,000
McCooleys Creek			20,000
Silver Creek			15,000
South Branch of Beaver Creek			40,000
Independence, Ammundson Creek			5,000
Borst Valley Creek			7,500
Branch of Chimney Rock Creek			5,000
Menomonie, Kings Creek			6,000
Lambs Creek			9,000
Silver Creek			9,000
Wilson Creek			12,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Prentice, Jump River			3,000
Solon Springs, Long Lake			5,000
Sparta, Bailey Creek			1,632
Beaver Creek			1,632
Leon Creek			1,632
Lyons Creek			1,632
Tarr Creek			1,632
Trempealeau County, Fox Creek			1,000
West Salem, Bells Coulee Creek			1,000
Browns Creek			1,000
Browns Valley Creek			1,200
Flemmings Creek			1,500
Troman Creek			1,300
Whitehall, Barlow Valley Creek			6,000
Beaver Creek			6,000
Hay Creek			6,000
North Branch of Elk Creek			6,000
South Branch of Elk Creek			6,000
Japan:			
Yokohama, Japanese Government	87,500		
Total[a]	599,500	298,915	2,056,177

[a] 300 fry and 102,000 fingerlings were lost in transit.

ATLANTIC SALMON.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine:			
Brownville, Pleasant River			39,830
Penobscot County, Penobscot River		2,156,852	
Total		2,156,852	39,830

LANDLOCKED SALMON.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado:			
Twin Lakes, Twin Lakes			14,500
Maine:			
Abbot Village, Wilson Creek			4,000
Auburn, Auburn Pond		25,000	
Bingham, Pierce Pond			2,000
Camp Caribou, Parmachenee Club	10,000		
Danville Junction, Sabbathday Lake			1,500
Dedham, Branch Pond		5,000	21,000
Green Lake		23,000	50,500
East Orland, Toddy Pond			660
Enfield, Cold Stream Pond			3,000
Farmington, Blakesley's pond			1,000
Chain of ponds			1,500
Clearwater Lake			3,500
Flagstaff Pond			1,000
King and Bartlett ponds			1,000
Lion Lake			1,000
Rangeley Lakes			1,000
Sweets Lake			2,700
Varnum Pond			1,000
Foxcroft, Shippond Creek			5,000
Franklin, Donnells Pond			1,200
Molasses Pond			3,000
Webb's pond			1,500
Fryeburg, Lake Kezar			1,500
Grand Lake Stream, Dobsis Lakes			2,000
Grand Lake		11,569	29,524
Grand Lake Stream		8,000	25,805
Ox Brook Lake			1,000
Greenville, Moosehead Lake			8,000
Hartland, Moose Pond			3,000
Morrill Pond			1,500
Kennebunk, Kennebunk Pond			1,200
Locks Mills, Indian Pond			600
Twitchell Pond			600
North Anson, Hancock Pond			1,500
North Belgrade, Maine Fish Commission	75,000		
North Leeds, Pocasset Lake			1,500

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

LANDLOCKED SALMON—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine—Continued.			
Onawa, Lake Onawa			600
Oquossoc, Rangeley Lake		7,500	5,000
Orrington, Brewer's pond			1,000
Otis, Green Lake			3,000
Perry, Boyden Lake			1,500
Phillips, Mt. Blue Pond			1,000
Portage, Portage Lake		15,000	4,000
Presque Isle, Squaw Pan Lake			2,500
Rangeley, Rangeley Lake		10,000	
Rockland, Chichawaukee Lake			1,000
Hobbs's pond		7,000	
Sebago Lake, Sebago Lake			4,000
Skowhegan, Lake George			1,500
South Paris, Lower Stone Pond			1,500
Stockholm, Madawaska Lake			2,500
Thorndike, Lake St. George			4,000
Union, Crawford's pond			1,500
Warren, South Pond			1,000
West Paris, Concord Pond		6,650	
Wilton, Bacheldor Pond		5,000	
Lake Webb			2,000
Wilson Lake			1,500
Massachusetts:			
Clinton, Wachusett Reservoir		10,000	
Wilkinsonville, Massachusetts Fish Commission	10,000		
Worcester, Lake Quinsigamond			600
Michigan:			
Munissing, Cleveland Cliffs Iron Company	10,000		
Sault Ste. Marie, Michigan Fish Commission	10,000		
New Hampshire:			
Concord, Penacook Lake			1,000
Keene, Granite Lake		4,000	
Lake Sunapee, Lake Sunapee		12,071	834
Meredith, Lake Winnepesaukee			2,000
Newberg, Lake Sunapee			3,000
Potter Place, Pleasant Lake			500
West Springfield, Johnson's pond			300
Wolfeboro, Lake Winnepesaukee			1,000
New York:			
Lake George, Lake George			1,200
Prospect, Big Rock Lake			400
Tuxedo Park, Tuxedo Club	5,000		
North Carolina:			
Lake Toxaway, applicant	10,000		
Vermont:			
Essex County, Little Averill Lake			500
Greensboro Bend, Caspian Lake		17,096	
Norton Mills, Little Averill Lake		11,000	
Wisconsin:			
Woodruff, Wisconsin Fish Commission	20,000		
Total [a]	150,000	177,886	249,723

[a] Lost in transit 13,850 fry.

BLACK-SPOTTED TROUT.

Colorado:			
Aspen, Castle Creek Pond		15,000	
Hunters Creek		20,000	
Lincoln Creek		30,000	
Maroon Creek		20,000	
Roaring Fork River		30,000	
Willow Creek		15,000	
Bailey, Deer Creek		25,000	
Platte River		15,000	
Basalt, Frying Pan Creek		40,000	
Luchsinger' ponds		65,000	
Berrys Ranch, Eagle River		30,000	
Boulder, Boulder and St. Vrain creeks		40,000	
Cascade, Cascade Creek		25,000	
Cebolla, Cebolla Creek		45,000	
East Elk Creek		30,000	
Gunnison River		30,000	
Soap Creek		15,000	
West Elk Creek		15,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BLACK-SPOTTED TROUT—Continued.

State, locality, and disposition	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Cedaredge, Barren Lakes		65,000	
Forest Lake		40,000	
Twin Lakes		60,000	
Upper Eggleston Lake		40,000	
Chase, Bohannan Lake		5,000	
Cliff, Deer Creek		30,000	
Flat River and Cliff Lake		15,000	
South Platte River		50,000	
Clyde, Middle Beaver River		35,000	
Collbran, Cottonwood Creek		20,000	
Colorado Springs, Prospect Lake		20,000	
Creede, Rio Grande del Norte		30,000	
De Beque, Cottonwood Reservoir No. 4		20,000	
Rio Grande		65,000	
Delta, Spring Creek		50,000	
Delta County, Gunnison River and tributaries		240,000	
Denver, North Fork of Grand River		30,000	
Ranch Creek		20,000	
Stillwater Creek		20,000	
Dome Rock, North Fork of South Platte River		15,000	
Eagle, Eagle River		30,000	
Eckert, Fruit Growers Reservoir		10,000	
Estabrook, Roland Creek		30,000	
Fairplay, Four Mile Creek		30,000	
Little Fork of South Platte River		30,000	
Sacramento Creek		20,000	
South Fork of South Platte River		30,000	
Twelve Mile Creek		20,000	
Florisant, South Platte River		30,000	
Granby, Eight Mile and Indian creeks		20,000	
Frazer River		75,000	
Grand Lake		50,000	
South Fork of Grand River		10,000	
Strawberry Creek		20,000	
Grand Lake, North Inlet to Grand Lake		100,000	
Grand Mesa Lakes Station, Big Creek		10,000	
Buzzard Creek		10,000	
Cottonwood Lake		30,000	
Grove Creek		10,000	
Leon Creek		10,000	
Plateau Creek		10,000	
Grant, Platte River and Genesoa Creek		15,000	
Gunnison, Gunnison River		55,000	
Hartsel, South Branch of Platte River		30,000	
South Branch of South Platte River		30,000	
South Platte River		35,000	
Ivanhoe, Ivanhoe Lake		30,000	
Jefferson, Jefferson Lake		15,000	
Platte River		100,000	
Kline, Bohannon's ponds		50,000	
Leadville, Lower Arkansas River		20,000	
Rock Creek		20,000	
Sugar Loaf Reservoir		150,000	
Tennessee Creek		20,000	
Upper Arkansas River		20,000	
Upper Lake Creek		20,000	
Loveland, Big Thompson River		60,000	
Lyons, St. Vrain River		85,000	
Meredith, Jakeman Creek		20,000	
Minturn, Eagle River		25,000	
Nast, Frying Pan River		30,000	
Newcastle, Divi .e Creek		60,000	
Norrie, North Fork of Frying Pan River		30,000	
Pine Grove, North Fork of South Platte River		15,000	
Pitkin, Colorado Fish Commission	100,000		
Redstone, Crystal River		150,000	
Rosemont, East Beaver River		75,000	
Saderlin l, Gould Creek		35,000	
Salida, South Fork of Arkansas River		30,000	
Sapinero, Sapinero Creek		30,000	
Shawnee, North Fork of South Platte River		30,000	
South Platte, South Fork of South Platte River		15,000	
Sulphur Springs, Corral Creek		20,000	
Grand River		40,000	
Willow Creek		30,000	
Telluride, Bilk Creek		20,000	
Davis's lake		20,000	
Tercio, Las Animas River		50,000	

Details of Distribution of Fish and Eggs—Continued.

BLACK-SPOTTED TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Thomasville, Fellows Lake and Spring Creek		15,000	
Frying Pan River		116,000	
Lime Creek		30,000	
Spring Creek		20,000	
Woods Lake		275,000	
Trinidad, Las Animas River		20,000	
Webster, Gibson Lake		5,000	
Whitewater, Kannah Creek		30,000	
Idaho:			
Hailey, Deer Creek			10,000
Ketchum, Cold Springs Pond			2,000
Kootenai County, Bonanza Lake		11,975	45,000
Mackay, Cress Creek			6,000
Montpelier, Hayes's pond			2,000
Middle Spring Pond			2,000
North Spring Pond			2,000
Moscow, West Fork of Bear Creek		3,680	
Pocatello, Portneuf River			28,000
Rigby, Reservoir			5,000
St. Anthony, Kunz's pond			5,000
Twin Falls, Snake River			20,000
Weiser, Monroe Creek		13,960	
Iowa:			
Manchester, Spring Branch			16,500
Minnesota:			
Whalan, Gribbons Creek			3,000
Montana:			
Alder, Wigwam Creek			7,800
Alhambra, Warm Springs Creek			8,000
Assinniboine, Beaver Creek			10,000
Bakers, Sixteen Mile Creek			25,000
Belt, Belt River			12,000
Bernice, Little North Boulder Creek			8,000
Bonita, Babcock Creek			5,000
Gilbert Creek			5,000
Ranch Creek			8,000
Rock Creek			10,000
Spring Creek			5,000
Stony Creek			4,000
Bonner, Big Blackfoot River			10,000
Bozeman, Cottonwood Creek			10,000
Kentside Pond			2,000
Butte, applicant	150,000		
Cascade, Sheep Creek			20,000
Smith River			21,000
Clancey, Alhambra Lake			2,000
Hollins, Spring Creek			11,000
Concord, Concord Reservoir			10,000
Craig, Dearborn River			25,000
North Fork of Sun River			25,000
Stickney Creek			15,000
Crow Agency, Little Big Horn River			26,000
Dorsey, North Fork of Smith River			10,000
Elk Park, Bison Creek			10,000
Eureka, Glen Lake			10,000
Gallatin County, Bridger Creek			3,000
East Gallatin River			1,000
Stony Creek			1,000
Helena, Beaver Creek			12,000
Kalispell, Creig's pond			11,000
Lewistown, Anderson's pond			3,000
Cottonwood Creek			18,000
East Fork of Big Spring Creek			10,000
Hopkins Pond			10,000
Liddy, Kootenai River			15,000
Livingston, Cold Creek			8,000
Holt's pond			5,000
Manhattan, Bulls Run Creek			5,000
Martinsdale, Spring Creek			8,000
Minden, Sixteen Mile Creek			53,000
Moore, Trout Creek			8.000
Pipestone Springs, Pipestone Creek			8,000
Race Track, Race Track Creek			8,000
Red Rock, Medicine Lodge Creek			10,000
Saltese, St. Regis River			10,000
Thompson, Groves Creek			9,000
Twodot, Musselshell River			15,000
Townsend, Deep Creek			15,000
Troy, Hutton's lake			8,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BLACK-SPOTTED TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Troy, Spring lake			8,000
Whitehall, Whitehall Creek			10,000
Whitefish, Whitefish River			8,000
Wolf Creek, Dearborn River			25,000
Prickly Pear Creek			25,000
Woodville, Nez Perce Creek			5,000
Nebraska:			
Andrews, White River			20,000
Chadron, Deadhorse Creek			15,000
Little Bordeaux Creek			15,000
Irwin, Irwin Lake			10,000
New Mexico:			
Chama, Chama River		50,000	
Cloudcroft, Sidebottom's pond		5,000	
Espinola, Jemez Creek		35,000	
Hebron, Ponil River		80,000	
Rayado Creek		30,000	
Las Vegas, Trout Springs		20,000	
Santa Fe, Nambe River		30,000	
Rio Quemado		30,000	
Rio Tesuque		30,000	
Santa Fe River		30,000	
Servilleta, Pueblo Creek		30,000	
Rio Chiquita		30,000	
Rio Grande del Rancho		30,000	
Rio Hondo Creek		30,000	
Rio Lucero Creek		30,000	
Silver City, Gila River		50,000	
New York:			
New York City, New York Aquarium	10,000		
North Dakota:			
Bowdon, Clear Lake		7,000	
Lisbon, Laughlin's pond		4,000	
St. John, Vine Lake		7,000	
Oregon:			
Oregon City, North Fork of Molalla River		6,000	
Trout Creek		6,000	
Rogue River Station, Elk Creek		900	
Pennsylvania:			
Pleasant Mount, Pennsylvania Fish Commission	100,000		
South Dakota:			
Buffalo Gap, Beaver Creek			20,000
Deer Lick, Beaver Creek			15,000
Elmore, East Branch of Spearfish Creek			25,000
Spearfish Creek			25,000
West Branch of Spearfish Creek			30,000
Englewood, Elk Creek			20,000
Spearfish Creek			15,000
Hill City, Grizzly Lake			10,000
Iron Creek			5,000
Spring Creek			10,000
Hot Springs, Cascade Creek			10,000
Piedmont, Elk Creek			10,000
Pluma, Bear Butte Creek			25,000
Rapid City, Crystal Springs Pond			8,000
Graves's pond			4,000
Rapid Creek			40,000
Rochford, Little Rapid Creek			20,000
Rapid Creek			20,000
Spearfish, Cox's lake			5,000
Crow Creek			15,000
Franklin Creek			10,000
Higgins Gulch Creek			5,000
Smiths Springs			5,000
Spearfish Creek			20,000
Watercress Creek			10,000
Shannon County, Wounded Knee Creek			20,000
West Nahant, West Fork of Little Rapid Creek			20,000
Utah:			
Ogden, Kundsen Springs		15,000	
Ogden River		63,800	
Packham's pond		10,000	
Spring Creek		15,000	
Stallings's pond		10,000	
Provo, Midway Spring Creek Pond		10,000	
Provo River		60,000	
Salina, Lost Creek		17,500	
Salina Creek		17,500	
Springville, Soldier Creek		75,000	
Thistle, Thistle Creek		30,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BLACK-SPOTTED TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Vermont:			
Brattleboro, Applicant	30,000		
Virginia:			
Hot Springs, Cowardins Run			1,200
Kelleys Run			1,200
Mud Run			1,200
Thompsons Run			1,200
Washington:			
Deer Park, Bridegroom Creek		5,925	15,000
Lamberts Siding, Lambert Creek		4,975	
Newport, King's lake		11,975	
Pomeroy, Houser's pond		1,960	
Republic, Lambert Creek			10,000
Rosalia, Voelker's pond		2,990	5,000
Walla Walla, Mill Creek		6,990	
Winlock, Bill Creek Pond		3,000	
West Virginia:			
Alderson, Mill Creek			1,000
Wyoming:			
Aladin, Little Beaver Creek			6,000
Beulah, Sand Creek			27,150
Cambria, Plum Creek			15,000
Green River, Green River		20,000	
Hermosa, Dale Creek		85,000	
Laramie County, Dale Creek		65,000	
Ranchester, Wolf Creek			19,800
Wyoming Fish Commission	100,000		
Rock River, Rock River		25,000	
West Thumb, Fisheries Creek		100,000	
Duck Lake		115,000	
Total[a]	490,000	5,323,130	1,382,050

[a] 150,470 fry and 2,400 fingerlings were lost in transit.

LOCH LEVEN TROUT.

South Dakota:			
Savoy, Little Spearfish Creek			67,000

LAKE TROUT.

California:			
Brookdale, Santa Cruz County Hatchery	50,000		
Connecticut:			
Canaan, Lake Washinee		15,000	
Large Pond		10,000	
Long Pond		7,500	
Twin Lakes		7,500	
West Cornwall, Cream Hill Lake		10,000	
Windsor Locks, Connecticut Fish Hatchery	300,000		
Indiana:			
Ligonier, Diamond Lake		6,000	
Maine:			
Chapmans Landing, Green Lake		71,012	
East Wilton, Pease Pond		10,000	
Hartland, Moose Pond		15,000	
Monmouth, Maine Fish Commission	200,000		
Massachusetts:			
South Wareham, Adirondack League Club	50,000		
Michigan:			
Charlevoix, Lake Michigan		1,300,000	
Detour, Lake Huron		2,000,000	
Eagle Harbor, Lake Superior			320,000
Fish Island, Lake Superior		400,000	
Grand Portage, Lake Superior		320,000	
Isle Royal, Lake Superior		640,000	480,000
Irishmans Reef, Lake Michigan		2,400,000	
Manistique, Lake Michigan		300,000	
Marquette, Lake Superior		700,000	
Michigan Shoals, St. Marys River		850,000	
Munising, Cleveland Cliffs Iron Company	200,000		
North Point, Lake Huron		2,580,000	
Northville, Union Lake		10,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

LAKE TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Michigan—Continued.			
Ontonagon, Lake Superior		1,400,000	225,000
Point Iroquois, Lake Superior		500,000	
Sault Ste. Marie, Hay Lake		1,000,000	
Michigan Fish Commission	2,000,000		
Scarecrow Island, Lake Huron		2,410,000	
Skillagillee Reef, Lake Michigan		1,300,000	
Tobins Harbor, Lake Superior		960,000	
Washington Harbor, Lake Superior		800,000	
Whitefish Point, Lake Superior		1,000,000	
Minnesota:			
Aitkin, Mille Lacs			20,000
Avon, Spunk Lake			15,000
Beaver Bay, Lake Superior		240,000	
Duluth, Lake Superior			756,000
Glenwood, Minneiska Lake			20,000
Grand Marais, Lake Superior			280,000
Knife River, Lake Superior			280,000
Sauk Rapids, Watab Lake			15,000
Split Rock, Lake Superior		280,000	
Two Harbors, Lake Superior			520,000
Nevada:			
Carson, Nevada Fish Commission	100,000		
New Hampshire:			
Laconia, New Hampshire Fish Commission	500,000		
Manchester, Greggs Lake		30,000	
Massabesic, Massabesic Lake		24,370	
Keene, Granite Lake		20,000	
Long Pond		25,000	
Spofford Lake		20,000	
Swanzey Pond		20,000	
Wolfeboro, Lake Winnepesaukee			600
New York:			
Auburn, Owasco Lake		26,000	
New York City, New York Aquarium	10,000		
Caledonia, New York Fish Commission	2,500,000		
Charity Shoals, Lake Ontario		1,614,400	
Cooperstown, Otsego Lake		28,000	
Gloversville, West Caroga Lake		25,000	
Grenadier Island and Lake Ontario		1,020,940	
Hemlock, Canadice Lake		25,000	
Hemlock Lake		25,000	
Peekskill, Indian Lake		20,000	
Point Peninsula, Lake Ontario		1,289,520	
Stringer Point, Lake Ontario		188,640	
Ohio:			
Kelleys Island, Lake Erie		500,000	
Put-in-Bay, Lake Erie		400,000	
Pennsylvania:			
Glen Eyre, Blooming Grove Hunting and Fishing Club	10,000		
Union City, Pennsylvania Fish Commission	2,500,000		
Vermont:			
Barton, Silver Lake		25,000	
Essex County, Big Averill Lake		60,650	
Greensboro, Caspian Lake		50,000	
Island Pond, Island Pond		10,000	
Roxbury, Vermont Fish Commission	500,000		
West Burke, Willoughby Lake		35,000	
Washington:			
Bellingham, applicant	50,000		
Tacoma, Spanaway Lake			5,000
Wisconsin:			
Brule River, Lake Superior			240,000
Iron River, Lake Superior		160,000	
Oshkosh, Wisconsin Fish Commission	14,500,000		
Sand Island, Lake Superior		160,000	
Solon Springs, Circle Lake			12,000
Wyoming:			
Wolfe, Wyoming Fish Commission	50,000		
Canada:			
Rossport, Lake Superior			200,000
Total[a]	23,520,000	27,344,532	3,388,660

[a] 5,000 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Alabama:			
Fort Payne, Steeles Lake			500
Arizona:			
Williams, Santa Fe Dam			800
Colorado:			
Antonio, El Casquer Lake			3,000
Arrow Head, Junction Lake		5,000	
Aspen, Clark's pond		10,000	
Taylor Lake		10,000	
Weller Lake		10,000	
Berrys Ranch, Eagle River		30,000	
Blackhawk, Dory Lake			8,000
Buena Vista, Cottonwood Creek			10,000
Day's pond		10,000	
Hartenstein's pond		10,000	
Schull's pond		5,000	
Buffalo Creek, Lake Cheeseman		40,000	
Wellington Lake		200,000	
Busk, Lake Park Creek		10,000	
Cerro Summit, Akard's lakes			8,000
Cimarron, Lake No. 2		15,000	
McIntyre Lake			8,000
Silver Tip Lake		10,000	
Creede, East Willow and Miners creeks		10,000	
Del Norte, Pienos Creek		15,000	
Doyle, Tomichi Creek			12,000
Eldora, Lake Eldora			6,000
Elizabeth, Big Spring Lake			4,985
Falcon, Atkin's reservoir			3,990
Florence, Smith's reservoir			4,000
Fort Collins, Buckhorn Creek			8,000
Bale Creek			8,000
North Fork of Cache la Poudre River			14,500
Gilpin County, South Boulder Creek		15,000	
Glenwood Springs, Canon Creek			6,000
Grizzly Creek			6,000
Mitchell Creek		20,000	
No Name Creek		25,000	
Granby, Grand Lake		15,000	
Strawberry Lake		10,000	
Grand County, Grand River		15,000	
Grand Junction, Kannah Creek			6,000
Grand Valley, Battlement Creek			4,500
Grant, Lamping's pond			4,000
Gunnison, Bird lakes			5,000
Elk Creek		15,000	
applicant	50,000		
Spring Creek			5,000
Tomichi Creek			12,000
Idaho Springs, Chinn's lake			10,000
Clear Lake			24,000
Sherwin's lake			10,000
Iola, Gunnison River			5,000
Ivanhoe, Ivanhoe Lake		15,000	
La Jara, Anchor Lake			3,000
Guyman's pond		4,500	
Knight's pond		4,500	
La Jara River		13,500	
Meadow Pond		4,500	
Lake County, Turquoise Lake			50,000
Larimer County, North Folk of Cache la Poudre River			8,000
Leadville, Arkansas River		15,000	
Colorado Gulch Pond			3,000
Iowa Creek			3,000
Lower Lake Creek			1,000
Musgroves Lake		200,000	
School Aquarium			36
Smiths Run			7,500
Sugar Loaf Reservoir		50,000	
Tennessee Creek		30,000	
Turquoise Lake		15,000	
Zoebles Lake		10,000	
Loveland, Big Thompson River			40,000
Ryan Gulch Reservoir			8,000
Lujane, Gunnison River			8,000
Lyons, Big Thompson River			30,000
Mount Pleasant Pond		5,000	
North Fork of St. Vrain River		15,000	
Malta, Homers Lake		5,000	
Smith's pond		15,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Malta, Twin Lakes			15,000
Minturn, Cross Creek			4,500
Monte Vista, Rock Creek		10,000	
South Fork of Alamosa River		15,000	
Montrose, Haskill Lake			4,000
High Park Lake			4,000
Jarvis Creek Pond		5,000	3,000
Middle Spring Creek			4,000
Right Fork of Spring Creek			4,000
Spring Creek Reservoir			4,000
Spring Lake			3,000
Whites Branch of Spring Creek			3,000
Morrison, Summit Lake			60,000
Newcastle, East Elk Creek			4,500
Norrie, North Fork of Frying Pan River		15,000	
Olathe, Spring Gulch Pond			5,000
Ouray, Lake Lenore		25,000	
Pagosa Springs, San Juan River			6,000
Pando, Eagle River		15,000	
Salida, Miklich's pond		5,000	
Ridgeway ponds		40,000	
Sapinero, Currecanti Creek		15,000	
Sapinero Creek		10,000	
West Elk Creek		25,000	
Tabernash, Crooked Creek		10,000	
Pole Creek		5,000	
St. Louis Creek		5,000	
Young's lake		5,000	
Thomasville, Lime Creek		15,000	
Savage Lake		10,000	
Spring Creek		10,000	
Woods Lake		100,000	
Twin Lakes, Twin Lakes		75,000	36,000
Vasquez, Frazer River		15,000	
Vasquez Creek		5,000	
Wagon Wheel Gap, Rio Grande		15,000	
Walsenburg, Dewey Lake		5,000	
Sunnyside Reservoir		5,000	
West Cliff, Deweese Reservoir			100,000
Connecticut:			
Bridgeport, Ackers Creek			100
Mill River Pond			2,000
Brookfield Junction, Silver Brook			500
Canaan, Blackberry River			1,000
Camp Brook			1,000
Furnace River			1,000
Konkapot River			1,500
Paul Brook			500
Roaring River			1,000
Steep Bank Creek			1,000
Upper Cheney Creek			1,000
Whiting River			1,000
Glenbrook, Woodway Pond			1,500
Goodspeed, Beebe Creek			2,100
Early Brook			1,500
Millington Brook			1,500
New Canaan, Bantown Creek			200
Five Mile Creek			200
Lockwood Creek			200
New London, Allderdice's pond			300
Norwalk, Silver Mine Creek			200
West Norwalk Creek			200
Unionville, Ulrich's pond			800
Waterbury, Hop Brook			1,500
Wilton, Sauguatuck River			200
Small streams and ponds			200
Delaware:			
Wilmington, Pine Glen Pond			2,000
Idaho:			
American Falls, South Fork of Rock Creek			1,500
Blackfoot, Blackfoot River			3,000
Boom Creek			800
Danilson Lake			1,500
Tanner Brook and Pond			800
Bliss, Bolman's pond			600
Cambridge, Weiser River			3,000
Kendrick, Big and Little Bear creeks			1,000
Boulder Creek			400
Cedar Creek			400

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Idaho—Continued.			
Kendrick, Long Meadow Creek			600
Potlatch River			1,000
Montpelier, Graham's spring pond			600
Montpelier Creek			2,500
Mountain Home, Lake Winter			800
Pebble, Portneuf River			2,000
Pocatello, Clear Creek			2,000
Post Falls, Spokane River			3,000
St. Anthony, Kunz's pond			1,500
"M. F." Lake			1,000
Milk Creek			1,200
Paradise Springs			1,000
Upper Sand Creek Lake			1,000
Soda Springs, Watercress Creek			1,000
Tikura, Silver Creek			2,000
Troy, Nelson's pond			1,000
Reirson's pond			1,000
Indiana:			
Crawfordsville, East Water Babble Pond		8,000	
Kennedy's pond		6,000	
Rome City, Knipp Sanitarium Pond		8,000	
Iowa:			
Cresco, Rutherford Brook			1,500
Decorah, Canoe Creek			650
Trout Pond			650
McGregor, Batchel Creek			2,000
Boss Creek			2,000
Osage, Spring Park Creek			300
Volga, Hewitt Creek			2,500
Waterville, Little Paint Creek			600
Paint Creek			750
Waukon, Hock Creek			950
Silver Creek			4,000
Kentucky:			
Horse Cave, Graves Branch			735
Maine:			
Attean, Attean Lake			1,500
Auburn, Maine Waters		81,200	
Bar Harbor, Eagle Lake			1,200
Belfast, Quantabacook Pond			1,200
Bethel, Wight Brook			800
Bigelow, Round Mountain Pond			1,200
Bingham, Carry Pond		8,640	
Rowe Pond		4,320	1,200
Young Pond		4,320	
Blue Hill, Billings Pond		20,000	
Wood's Pond		20,000	
Brownville Junction, Caribou Stream			1,500
Camden, Canaan Lake		40,000	
Carrabassett, Spring Lake			1,500
Cumberland Center, applicant	55,737		
Cumberland Junction, Redrock Pond			600
Sturdivant's pond		20,000	
Dead River Station, Greens Farm ponds			600
Dedham, Branch Pond		96,000	
East Wilton, Pease Pond			1,200
Ellsworth, Pattens Pond		25,000	
Trilobite Pond		10,000	
Farmington, Big Island Lake			1,200
Blakeslee Lake			1,200
Carleton Pond			1,000
Chain of ponds			10,000
Clear Water Lake		15,000	
Crosby Pond			10,000
Grant Pond			1,200
King and Bartlett lakes			1,200
Lion Lake			1,500
L Pond			11,200
Northwest Pond			11,200
Rangeley Lakes			8,000
Sweets Pond		9,500	2,400
Franklin, Abrahams Pond			1,200
Narragaugus Lake			1,500
Fryeburg, Lake Kezar			1,800
Gardiner, Purgatory Pond		20,000	
Sand Pond		20,000	
Grand Lake Stream, Dyer Cove Brook		15,000	
Farm Cove Brook		4,500	
Hatchery Cove		993	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine—Continued.			
Grand Lake Stream, Ox Brook		12,500	
Ripley Brook		1,600	
Green Lake, Green Lake		15,000	
Greenville, Arnold Pond			1,200
Crosby Pond			1,200
Moosehead Lake		35,000	
Greenville Junction, Maine Fish Commission	50,000		
Gull Pond, Gull Pond		7,500	
Holeb, Holeb Pond		24,000	
Katahdin Iron Works, Little Houston Pond		19,000	
Lisbon Falls, Little River and tributaries		25,000	
Locks Mills, Indian Pond			1,200
North Pond			1,600
Round Pond			800
South Pond			800
Twitchell Pond			1,200
McGeorges, Cathance Lake			2,000
Monmouth, Purgatory Pond			1,200
Sand Pond			1,200
Monson, Little Bear Pond			1,500
North Pond			2,500
Newport, Pillsbury Pond		20,000	
Onawa, Lake Onawa			3,000
Oquossoc, Rangeley Lake		14,400	2,200
Orono, Pushaw Lake		30,000	
Otis, Green Lake		310,399	
Portage, Fish River Lake		12,000	
Portage Lake			4,000
Presque Isle, Arnold Brook			1,200
Presque Isle River			2,000
Squaw Pan Lake			1,500
Rangeley, Dead River Pond			1,500
Rangeley Lakes		5,000	
Saddle Back Pond			1,500
Salmon Lake		7,500	
Rockland, Meadow Brook		25,000	
South Paris, Alum Pond			800
Pennesseewassee Lake		18,400	
Steep Falls, Saco River			2,000
Waldoboro, Back Brook		20,000	
Beaverdam Brook		20,000	
West Paris, Little Concord Pond		20,000	
Shag Pond		20,000	
Willimantic, Shippond Creek			6,170
Winthrop, Belgrade lakes			200
Maryland:			
Alesia, Washwater Branch			500
Baldwin, Divers Branch			500
Baltimore, Hilton Lake			400
Bel Air, Forwoods Run			500
Livezys Branch			1,000
Meadow Creek			500
Boyds, Walldene Spring			800
Whites Branch			1,000
Cumberland, Clarks Brook			500
Douds, Tuscarora Creek			500
Finksburg, Shipley's pond			300
Forest Hill, Long Branch			500
Glyndon, Lake Jorosa			200
Harford County, Peach Orchard Creek			500
Laurel Brook, Laurel Brook			500
Minefield, Mine Branch			500
Monkton, Powder Mill Run			600
Oakland, Lake Seneca			4,000
Marsh River			6,000
Morgantown Club Dam			6,000
Welsh's dam			4,000
Wilson Run Lake			8,000
Sewell, Ha Ha Branch			400
Sharon, Middle Branch			300
The Rocks, Gladdens Branch			500
Rock Vale Trout Creek			500
Washington Grove, Larcombe's pond			500
Massachusetts:			
Greenfield, Bunnington's pond			2,000
Long Brook			1,200
Haverhill, Parker River		10,000	
Whittlers Creek		5,000	
Hingham, Beechwood Creek			800

Details of Distribution of Fish and Eggs—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Massachusetts—Continued.			
Lincoln, Sturgis Creek			1,000
Northampton, Aherns Brook		5,500	
Longville Brook		5,500	
Parsons Brook		8,000	
Roberts Meadow Brook		7,000	
Running Gutter Brook		12,500	
Walsh Brook		11,000	
Northeast, Martins Brook		5,000	
South Deerfield, Chestnut Plain Brook		4,500	
Potash Brook		4,500	
Roaring Brook		4,500	
Spencer, Howe Brook		5,000	
Springfield, Hunt and Whittaker brooks			2,500
North Branch Brook		5,500	
Walpole, Lewis Pond			400
Westfield, East Branch of Farmington River		13,000	
Wilkinsonville, Massachusetts Fish Commission	30,000		
Worcester, Lake Quinsigamond			1,500
Michigan:			
Alpena, Bullock Creek		9,000	
Davis Creek		12,000	
Kelley Creek		11,000	
Morse Creek		8,000	
Muskrat Creek		8,000	
Newton Creek		12,000	
Norwegian Creek		8,000	
Silver Creek		8,000	
Simmons Creek		18,000	
Wild Cat Creek		8,000	
Baldwin, Baldwin Creek			3,000
Pine Creek		20,000	
Sanborn Creek			3,000
Bark River, Bark River			8,000
Calumet, Traprock Creek			2,000
Clare, Tobacco River		20,000	
Empire, Knox Creek		15,000	
Sullivans Creek		16,000	
Evart, Swan Creek		20,000	
Farwell, Coldwater Creek		20,000	
Grayling, Au Sable River		50,000	
East Branch of Au Sable River		50,000	
Tillula Lake		15,000	
Holly, Buckhorn Creek		8,000	
Honor, North Branch of Platte River		27,000	
Lovell, North Branch of Au Sable River		25,000	
Metropolitan, Quarry Creek			2,500
Muskegon, Spring Brook		8,000	
Negaunee, Walton Lake			2,500
Northport, Ennis Creek		17,000	
Oxford, Duck Creek		8,000	
Paint Creek		10,000	
Pine Creek		10,000	
Shadbolt Creek		8,000	
Tanners Brook		8,000	
Thurston Brook		8,000	
Roscommon, Pearsall Creek		8,000	
Sanger Creek		8,000	
Saint James, Mike Boyles Creek			2,500
Saline, Halls Creek		8,000	
Suttons Bay, Lerz Creek		10,000	
Watersmeet, High Lake			2,000
West Branch, Rifle River		15,000	
Wingleton, Pickerel Creek		25,000	
Sweetwater Creek		20,000	800
Tank Creek			1,000
Minnesota:			
Dakota, Dakota Valley Creek			400
Richman Valley Creek			300
Detroit, Sucker Brook			12,000
Grand Marais, Birch Lake			2,000
Hibbing, Beatrice Lake			12,000
Kellogg, Canfield Creek			500
Knife River, East Branch of Knife River		10,000	
Gooseberry Creek		10,000	
Split Rock River		10,000	
Stewart River		10,000	
West Branch of Knife River		20,000	
Lamoille, Big Trout Creek			500
Corey Valley Creek			400

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Minnesota—Continued.			
Lamoille, Little Trout Creek			2,900
Pickwick Creek			2,000
Pine Creek			3,000
Lewiston, East Branch of Whitewater Creek			500
Enterprise Creek			300
Ferguson Creek			300
Pine Creek			500
Rush Creek			3,500
Minnesota City, Middle Valley Creek			300
Rupprecht Valley Creek			2,500
Speltz Valley Creek			500
Plainview, Beaver Creek			2,000
East Indian Creek			2,000
Middle Creek			2,000
West Indian Creek			2,000
Creston, Cramp Creek			2,300
South Branch Loup River			3,000
Willow Creek			3,000
Proctor, Cedar Brook			12,000
Rocky Run			12,000
St. Charles, Drakes Branch of Whitewater River			2,000
Hemingways Creek			2,000
Middle Branch of Whitewater River			2,500
North Branch of Whitewater River			2,600
Pine Creek			2,500
Trout Run			5,700
Whitewater River			2,000
St. Peter, Roberts Creek			600
Stockton, Stockton Valley Creek			500
Winona, Bear Creek			400
Bear Valley Creek			2,000
Cedar Valley Creek			2,500
Corey Valley Creek			2,000
Dearings Valley Creek			2,000
East Burns Valley Creek			2,400
Gilmore Valley Creek			2,400
Gunthers Valley Creek			2,000
Harveys Valley Creek			2,000
Hauser Valley Creek			500
Hicks Coulee Creek			500
Laufenburgen Creek			2,400
Luney Valley Creek			2,000
Middle Valley Creek			2,000
Murray Valley Creek			2,500
Pleasant Valley Creek			4,000
Rupprechts Valley Creek			2,500
Straight Valley Creek			2,400
Trout Valley Creek			2,000
West Burns Valley Creek			2,400
Missouri:			
St. Joseph, Missouri Fish Commission	100,000		
Montana:			
Alder, Kirkwood Creek			1,000
Middle Creek			1,000
Odell Creek			1,500
Garner Creek			1,000
Anaconda, Warm Springs Creek			2,500
Belt, Belt River			2,800
North Fork of Little Belt Creek			1,000
Boulder, Little North Boulder Creek			2,000
Bonita, Kitchin Creek			1,200
Bonner, Bear Creek			3,000
Gold Creek			3,000
Johnson Creek			3,000
Spring Creek			3,000
Bozeman, Bridger Creek			5,000
Story Creek			15,000
Butte, Browns Gulch Creek			2,000
applicant	75,000		
Chester, Bournes Reservoir			1,125
Clancey, Upper Prickly Pear Creek			1,500
Deer Lodge, South Fork of Rock Creek			2,000
Dillon, Beaverhead River			5,000
Divide, Big Hole River			2,000
Lavelle Lake			2,000
Eureka, Indian Creek			800
Fort Benton, Shonkin Creek			4,000
Garneill, East Buffalo Creek			1,200
Glen, Willow Creek			1,970

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Gold Creek, Carter Creek			1,500
Great Falls, Pilgrim Creek			1,200
Hardy, Hardy Creek			1,500
Harlowton, Swimming Woman Creek			2,000
Kalispell, Greig's pond			800
Lewistown, Castle Creek			2,500
Overland Pond			4,900
Surprennant's pond			600
Melrose, Canon Creek			1,980
Monida, Grayling Creek			1,000
Neihart, Belt River			2,800
Red Rock, Dod Creek			1,500
St. Regis, Terrace Home Pond			400
Saltese, Black Eagle Lake			800
Dominion Creek			1,200
Silver Lake			1,600
Sheridan, Mill Creek			1,500
Straw, East Buffalo Creek			4,900
Stryker, Dickey Lake			1,500
Troy, Spring Lake			600
Twodot, Basin Creek			2,000
Big Elk Creek			2,000
Whitehall, Branch of Fish Creek			2,000
Nebraska:			
Chadron, Big Bordeaux Creek			19,575
Gordon, Niobrara River			10,000
Rushville, White Clay Creek			1,000
Nevada:			
Carson, Nevada Fish Commission	100,000		
New Hampshire:			
Ashland, Dick Brown Brook			500
Bath, Wild Ammonoosuc River		10,000	
Bedford, Shepards Brook		8,000	
Berlin, Wight's pond		20,000	
Bradford, Newbury Meadow Brook			400
Brookline, Withey Brook		5,000	
Canaan, Davis Brook			400
Indian Creek			600
Moose Brook		15,000	
Claremont, Bailey Brook			500
Peabody Brook			500
Redwater Brook			1,000
Tyler Pond		10,000	
Concord, Ash Brook			800
Bear Brook			600
Buzzell Brook			400
Cold Brook			400
Dallaff Brook			400
Eastman Branch			400
Onestack Creek			400
Row Brook Pond			400
Sibley Pond			1,000
Suncook River			1,000
White Rock Branch			400
Derry, Dipple Pond			400
East Tilton, Patterson Brook			400
Enfield, Butman Brook			600
Committee Meadow Brook			600
Stow Brook			500
Exeter, Dudley Brook			800
Franklin, Call Brook		5,000	800
Mountain Brook		8,000	400
Putney Brook		5,000	400
Grafton, Wild Meadow Pond and Brook		10,000	400
Greenfield, South, Rand, and Farrington brooks			600
Straw Brook		5,000	
Preston Pond			600
Hill, Main Brook			500
Hillsboro, Island Pond		20,000	
Hollis, Flint Brook		8,000	
Great Brook			800
Hardys Brook		5,000	
Hookset, Wood Brook			600
Keene, Branch Brook		15,000	
Nelson Brook			600
Rixford Brook			1,200
Spalding and Hubbard brooks			1,000
Lake Sunapee, Lake Sunapee			5,030
Lee, Fifield Brook		4,900	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New Hampshire—Continued.			
Manchester, Baboosic Creek			600
Bowan Brook			500
Catamount Creek			800
Cemetery Brook			500
Dumpling Brook			400
Farm Brook			400
Goldsmith Brook		8,000	
Little Cohas Brook			500
Manter Brook			500
Nigger Brook			400
Ray Brook		10,000	
Reeds Brook			500
Sand Creek			400
Tannery Brook			400
Uncanoonuc Brook			400
Walker Brook			400
Mount Vernon, Harwood Lake			800
Nashua, Bailey and Toddy brooks		8,000	
Chase Brook			800
Peacock Brook			600
Smalley's pond		5,000	
Newport, Flowed Lands Pond			1,000
Newton Brook		8,000	
North Boscawen, Sterapine Brook			500
North Woodstock, Russell Pond			1,460
Penacook, Millbrook			400
Peterboro, May Brook			600
Wallace Brook			600
Wilder Brook			600
Portsmouth, Dearborn Brook			400
Pickering Brook			400
Potter Place, French Brook			400
Sanborn Brook			400
Rochester, Green Hill Brook			800
Mohawk Creek		9,800	
Sanbornville, Mountain Lake Pond			2,000
South Lyndeboro, Stephenson Brook			600
Troy, Fassett Brook			1,000
Nana Pond		5,000	
Reservoir Brook			1,000
Warner, Meadow Brook			500
Silver and Bartlett brooks			400
Stevens Brook			400
Wentworth, Bakers River			1,925
West Ossipee, White Lake		11,800	
Whitton Pond			1,000
Whitefield, Carrol Creek		15,000	
Goodwin's pond		5,000	
Wilton, Stony Brook		8,000	
Winchester, Mirgs Brook			800
New Jersey:			
Beaver Lake, Black Brook			500
Branchville, Beavans Spring Brook			1,000
Big Flat Brook			6,500
Ellia Brook			1,000
Little Flat Brook			5,500
Stony Brook			1,000
Boonton, Spring Brook			500
Grenloch, Grenloch Lake			1,500
Little Fairy, Burry Spring			500
Ogdensburg, Mill Brook			500
Passaic, McDaniels Brook			500
Princeton, Devils and Bear brooks			2,500
Sparta, Sherman Mine Brook			500
Sparta Creek			500
Williamstown, Silver Run			2,000
New Mexico:			
Chama, Chama River			7,000
Colfax County, Vernal Lake			6,000
Leandro Lake			6,000
Vermejo River			8,000
Glorieta, Pecos River			11,900
New York:			
Apalachia, Apalachian Creek		20,000	
Apulia, Butternut Creek		40,000	
Cold Creek		10,000	
Gallinger Brook		12,000	
Gleason Brook		12,000	
Onondaga Creek		15,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New York—Continued.			
Apulia, Osborne Creek		10,000	
Vincent Brook		10,000	
Auburn, Chestnut Ridge Brook		24,000	
Cold Springs Brook		10,000	
North Brook		12,000	
Babylon, Phelps Pond			1,500
Big Indian, Esopus Creek		30,000	
Bliss, Flint Brook		12,500	
North Branch of Wiscoy Creek		12,500	
Tonawanda River		25,000	
Town Line Creek		25,000	
Caledonia, New York Fish Commission		100,000	
Cambridge, Battenkill Creek		44,000	
Pomnanok Creek		14,000	
Drydon, Six Mile Creek			1,900
Virgil Creek			2,500
East Worcester, Schenevus Creek		12,000	
Freeville, Fall Creek, tributaries			1,300
Harford Mills, Owego Creek, tributaries			1,900
Napanoch, Yama-uchi ponds			800
New Paltz, Cold Spring Brook		10,000	
Silver Creek		10,000	
Sundown Creek		10,000	
Trap Creek		15,000	
Upper Plattenkill Creek		15,000	
New York City, New York Aquarium	5,000		
North Java, Tonawanda Creek		50,000	
Northville, Sacandaga River		15,000	
Nyack, Larchdell Pond			250
Owego, Doolittle Creek		16,000	
Little Nanticoke Creek		16,000	
Steadman Creek		10,000	
Talcott Brook		10,000	
Petterson, Croton River			1,000
Quaker Brook			1,000
Pawling, Headwaters of Croton River			600
Port Henry, Hatch Pond		40,000	
Raquette Lake, Lake Kora		30,000	
Saint Regis Falls, East Brook		30,000	
Saranac, New York Fish Commission		80,990	
Sauquoit, King's pond		15,000	
Schenectady, Horstmyer's pond		12,000	
Syracuse, Carpenter Brook		12,000	
Judd Brook		10,000	
Mount Friedey Brook		10,000	
Watertown, Eames Creek		17,500	
Hogsback Gulf Creek		15,000	
Kimball's creek		14,000	
Mill Creek		15,000	
South Branch of Sandy Creek		17,500	
Stebbins and Stockwell Creek		14,000	
Taylor Farm Creek		12,000	
North Carolina:			
Asheville, Lake Burroughs			8,000
Boonford, Junaluska Lake			12,400
Nolichucky River			974
Brevard, Little River			3,500
Williamston Creek			2,000
Canton, Right Fork Pigeon Creek			3,000
Cranberry, Grandmother Creek			5,000
Elk Park, Elk Creek			16,000
Flat Rock, Murray Creek			5,000
Forney, Bear Creek			600
Bee Creek			500
Forneys Creek			1,000
Hendersonville, Brittons Creek			1,500
Finley Mill Creek			400
Hanckels Creek			1,000
Mill Creek			1,000
Murray Creek			4,000
Upper Mud Creek			400
Huntdale, Nolichucky River			30,000
Lake Toxaway, Bear Wallow Creek			1,000
Big Hogback Creek			2,000
Chimney Top Creek			2,000
Fairfield Lake			2,000
Horsepasture River			3,950
Indian Creek			7,450
Lake Toxaway			50,000

Details of Distribution of Fish and Eggs—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.			
Lake Toxaway, Nix Creek			2,000
Sapphire Lake			3,600
Tuckaseigee River			2,000
Whitewater River			1,800
Manchester, Black Branch Pond			2,000
Marion, Burgins Creek			600
Curtis Creek			800
Gladie Creek			800
Harris Creek			800
Jokes Creek			800
Licklog Creek			4,000
Little Buck Creek			600
Little River			1,600
McKeys Creek			800
Osbornes Creek			600
Otter Creek			600
Paddy Creek			800
Paxtons Creek			600
Morganton, Upper Creek			2,000
Rutherfordton, Bingham Branch			900
Southern Pines, McKinnon Creek			300
Palmer's pond			150
Toe Cane, Little Rock Creek			10,000
Transylvania County, Horsepasture River			2,350
Indian Creek			2,350
Tryon, Vaughans Creek			1,400
Waynesville, Abels Creek			1,500
Allen Creek			700
Bald Creek			900
Big East Fork Pigeon Creek			900
Camp Creek			500
Crawford Creek			3,700
Dicks Creek			1,500
Johnathan Creek			1,200
Kelleys Creek			1,500
Lenoir Creek			2,500
Medford Creek			300
Raccoon Creek			800
Shining Creek			2,400
Winchester Creek			800
Zirconia, Green River			2,800
Ohio:			
Castalia, Castalia Trout Club Company	100,000		
Bellefontaine, Zanesfield Trout Creeks		32,000	
Perry, Lockwood Creek		16,000	
Solon, Ogeedankee Pond			125
Sand Rock Spring		5,000	
Unionville, Cunningham Creek		21,000	
Oregon:			
Elgin, Cabin Creek		1,000	
Falls City, Little Luckiamute River		2,994	
Fort Stevens, Swash Lake		2,000	
Hood River, Lost Lake		4,000	
Phelps Creek		2,500	
La Grande, Spring Creek		2,000	
Milwaukee, Crystal Lake		5,000	
Oregon City, Bee and Canyon Creeks		2,500	
Cedar Creek		3,000	
Milk Creek		2,500	
Pennsylvania:			
Altoona, Homers Gap Run			700
Potts Grove Run			500
Reggles Gap Run			800
Wopsononock Run			1,000
Andreas, Furnace Brook			300
Ashland, Blass Creek			500
Brush Valley Creek			1,000
Buck Mountain Pond			400
Elliotts Creek			400
Hofnagle Creek			400
Rattling Run			300
Roaring Creek			1,600
Sand Springs Run			800
Whites Run			300
Witners Run			400
Bedford, tributaries to Bobs Creek			3,000
Peech Creek, Fanguascootac Creek			2,000
Bellefonte, Beaver Creek			1,400
Beech Creek			1,400

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Bellefonte, Big Eddy Creek			1,400
Forked Springs Creek			1,400
Little Eddy Creek			1,400
Little Sandy Creek			1,400
Logans Branch Creek			700
Penn Creek			1,400
Spring Creek			1,600
Wolf Run			1,400
Bellwood, Trout Run			500
Benton, Coles Creek			1,500
Fishing Creek			2,000
Green Creek			1,500
Little Fishing Creek			5,600
West Creek			1,500
Blairs Mills, Branch Tuscarora Creek			1,000
Flemmings Spring Run			2,000
Blossburg, Bear Run			500
Beaverdam Creek			500
Blacks Creek			1,000
Bogarts Creek			500
Booming Creek			500
Canoe Camp Creek			500
Coon Creek			500
Cox Run			500
Douds Creek			500
East Creek			500
Fall Creek			1,500
Flower Run			500
Happy Hollow Creek			500
Lime Kiln Creek			1,000
Long Run			1,000
Mays Creek			500
Nichol Brook			500
Paint Brook			500
Seven Shanty Run			500
South Creek			500
Tabor Run			1,000
Tan Creek			500
Wilson Creek			500
Wolf Creek			500
Zimmerman Run			500
Bridgeton, Orson Creek			500
Sawmill Run			500
Bruin, Chansies Run			1,000
Clear Creek			1,000
North Bear Creek			1,000
Bryn Mawr, Saranac Brook			1,500
Bushkill, Toms Creek			2,400
Canton, Alba Creek			500
Baldwin Creek			500
Bates Creek			500
Branch of Rock Run			500
Brown Creek			500
Coons Creek			500
Cosper Creek			500
Dry Run			500
Fellows Creek			500
Hoaglands Branch			500
Hound Run			500
Innis Creek			500
Lake Run			500
Little Creek			500
Lock Creek			500
Lye Run			500
Mays Run			500
Maze Creek			500
Meeker Creek			500
Mill Creek			500
Morgan Creek			500
Pine Swamp Run			500
Rathbone Creek			500
Salt Spring Run			500
Schrader Branch			1,000
Seymour Creek			500
Spring Brook			500
Sugar Work Run			500
Taber Creek			500
Tanners Creek			500
Towanda Creek			2,500

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Canton, Union Creek			500
Williams Creek			500
Wynne Creek			500
Carlisle, Bonny Brook			400
Letort Creek			1,000
Center Bridge, Rogers Pond			1,500
Centralia, Hells Kitchin Creek			1,000
Kostenbander's pond			1,000
Roaring Creek			1,500
Whiskey Mill Creek			1,000
Chambersburg, Birch Run			8,625
Carbaughs Run			1,000
Hoosic Run			8,625
Mountain Brook			1,000
Raccoon Run			7,625
Trout Run			7,625
Clearfield, Anderson Creek			1,000
Bear Run			1,000
Brush Run			500
Cold Spring Run			2,000
Coupler Run			1,000
Crooked Run			1,000
Curry Run			1,000
Deer Creek			1,000
Dixon Run			500
Doctors Fork Creek			790
Enochs Branch			1,000
Fork Run			1,000
Gifford Branch			1,000
Harbsters Run			1,000
Hogback Run			500
Hoover Run			500
Irish Creek			800
Klines Branch			1,000
Laurel Run			1,000
Lick Run			1,000
Little Anderson Creek			1,000
Little Trout Run			1,000
McGeorge Branch			500
Mill Stone Run			500
Moose Creek			1,000
Moravian Run			1,000
Morgan Run			2,000
Mosquito Creek			1,000
Nelson Run			1,000
Norris Run			500
Ogden Run			1,000
Patchel Run			1,000
Rattlesnake Run			500
Roaring River			1,000
Rockton Branch			500
Sandy Creek			500
Seven Mile Run			1,000
Spence Run			1,000
Stony Creek			1,000
Stone Run			1,000
Surveyor Run			1,000
Wallace Run			500
Wilson Run			1,000
Wolf Run			500
Woods Run			1,000
Coburn, Donners Leich Creek			400
East Elk Creek			500
Elk Creek			500
Phillips Creek			500
Pine Creek			600
Rough Run			400
Spring Bank Run			400
Turpentine Creek			500
West Elk Creek			500
Cogan Valley, Big Sandy Creek			500
Buckhorn Run			500
Carters Run			500
Hogland Run			1,000
Kinley Hollow Run			500
Kyles Gap Run			500
Little Gap Creek			500
Reigard Run			500

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Cogan Valley, Stony Gap Run			500
Wolf Run			500
Coudersport, South Branch			1,000
Cresco, Broadheads Creek			1,200
Buckhill Creek			1,200
Levis Branch			1,200
Dorset, Staud's pond			700
Eagles Mere, Rusty Run			800
East Waterford, Cisneys Run			1,000
Hampton Run			1,000
Horse Valley Creek			2,000
Ebensburg, Clear Creek			1,000
Davis Creek			1,000
Kaylor Creek			1,000
Little Chest Creek			1,000
Parish Creek			1,000
Winding Run			1,000
First Fork, Logues Run			1,000
Florrin, Big Spring			1,000
Glen Union, Baker Run			3,500
Benjamin Creek			400
Blood Run			300
Clendenny Creek			500
Cold Fork Creek			300
Crab Apple Run			300
Cranberry Creek			400
Joseph Run			300
Mill Run			1,500
Rock Run			400
Rodgers Run			300
Shoemaker Run			300
Smoky Hollow Run			300
Square Run			300
Gordon, Johan Creek			800
Haleeka, Doughertys Run			500
Hallstead, Big Snake Creek			1,200
Cold Spring Brook			1,200
Harmony Creek			1,200
Wiley Creek			1,200
Hawley, Mill Creek			1,200
Hellam, Bulls Run			700
Henrietta, Clover Creek			2,500
Henryville, Broadhead Creek			1,200
Hollidaysburg, Cove Creek			500
Fox Run			1,000
Honey Grove, Liberty Valley Creek			1,000
Mountain Brook			1,000
Little Run			2,000
Huntingdon, Garners Run			1,000
Hyner, Hyner Run			1,500
Indiana, East Branch of Brush Creek			1,000
Jamison City, Blackberry Creek			600
Branch of Fishing Creek			600
Cole Cabin Run			600
East Branch of Fishing Creek			600
Elk Run			1,800
Fishing Creek			1,200
Hog Run			600
Long Run			600
Meaker Run			600
Pigeon Run			1,200
Rough Run			600
Sullivan Branch Fishing Creek			600
Trout Run			600
Johnstown, Bens Creek			2,000
Lamar, Fishing Creek			400
Lansdowne, tributary of Darby Creek			1,500
Laurel, Lynchs Run			300
Lewisburg, Bull Run			1,400
Cherry Run			500
Laurel Run			1,400
Panther Run			2,100
Poe Run			1,400
Rapid Run			5,000
Spruce Run			3,800
Swift Run			2,000
The Branch Creek			700
Turtle Creek			1,400
Weikert Creek			3,600

Details of Distribution of Fish and Eggs—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Lewisburg, White Deer Creek			2,100
Lockhaven, Branch of McElhattan Creek			1,000
Chathams Run			1,000
Cherry Run			1,000
Glise Run			1,000
Hemlock Run			1,000
Jerrys Run			1,000
McElhattan Creek			1,000
Plum Run			1,000
Queens Run			3,000
Ranun Hollow Run			1,000
Shaffen Run			1,000
Shingle Branch Run			1,000
Sugar Run			1,000
Winters Run			1,000
Mahanoy City, Codorus Creek			600
Husersock Creek			500
Marietta, Cassell Creek			1,300
Charles Run			700
Donegal Creek			1,200
Dugans Run			600
Evans Run			600
Graybills Pond			200
Hoffman Run			700
Mussers Run			700
Marion Center, Water Company pond			1,000
Martinsburg, Piney Creek			1,000
Mifflinburg, Aikeys Run			700
Bayers Gap Run			700
Boiling Spring Run			700
Brush Hollow Run			700
Dry Hollow Run			700
First Gap Run			700
Second Gap Run			700
Third Gap Run			700
Fourth Gap Run			700
Fifth Gap Run			700
Hagars Run			700
Hatfields Run			700
Hildebrands Run			700
Klines Run			700
Limestone Run			700
Lukens Gap Run			700
Molls Hollow Run			700
North Branch			700
Panther Run			700
Pine Swamp Run			700
Rapid Run			2,100
Raritan Run			700
Reishs Run			700
South Fork Creek			700
Spruce Creek			700
Weirichs Creek			700
White Deer Creek			1,400
Wohlheiter Run			700
Yankee Run			700
Mill Hall, Fishing Creek			2,000
Minersville, Black Creek			800
Buck Creek			600
Dyers Run			300
Indian Run			400
Wagners Run			400
Wheelers Creek			300
Montoursville, Calebs Creek			500
Moscow, Daleville Creek			1,200
Mount Carmel, Brush Valley Creek			1,150
Mount Etna, Roaring Run			1,000
Muddy Creek Forks, Bell Hollow Creek			400
Nanticoke, Tunkhanna Creek			1,200
Newtown Square, Indian Creek			1,500
Nisbet, Benders Run			1,500
Nordmont, Chappel Run			1,000
Cherry Run			1,000
Deephollow Creek			1,000
Gritman Run			1,000
Hunter Run			1,000
Lang Brook			1,000
South Branch Creek			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Oak Hall, Cedar Creek			700
Galbraiths Gap Run			700
Spring Creek			1,400
Ohiopyle, Laurel Run			1,000
Patten, Annas Run			500
Beaverdam Run			500
Chest Springs Run			500
Kill Buck Run			500
Mulligan Run			500
Rock Run			500
Paxinos, Irish Creek			1,000
Phillipsburg, Beaver Run			1,000
Benner Run			2,000
Black Bear Creek			1,500
Black Moshannan Creek			1,500
Clover Run			1,000
Cold Run			1,000
Corbin Run			1,000
Forge Run			1,500
Four Mile Run			1,500
Hunten Run			1,000
Mountain Branch			1,500
Mountain Run			1,000
One Mile Run			1,000
Rock Run			1,000
Six Mile Run			1,500
Smays Run			1,000
Sorrel Run			1,000
Tom-tit Run			1,000
Pottsville, Big Creek			1,000
Burglebachs Run			2,000
Eicherts Creek			1,000
Rilands Creek			1,600
Sand Run			600
Reading, Angelica Creek			1,500
Black Bear Creek			600
Brumerskill Creek			1,500
Catoosing Creek			400
Kutz Run			1,500
Ritters Run			1,500
Spring Creek			1,750
Stums and Stinson creeks			1,500
Willow Creek			1,500
Wyoming Creek			500
Rockwood, Back Creek			875
Laurel Run			875
Meals Run			875
Reese Run			875
Shrewsbury, Deer Creek			2,100
Snow Shoe, Beech Creek			1,500
Big Sandy Creek			1,000
Horsehead Run			1,000
Little Sandy Creek			1,000
Raven Run			1,000
South Fork of Beech Creek			1,500
Stink Town Run			1,000
Stillwater, Raven Creek			1,500
Stroudsburg, Hipsies Creek			1,200
Little McMichaels Creek			1,200
McMichaels Creek			1,200
Marshalls Creek			1,800
Pensyl Creek			1,800
Spragle Run			1,800
Stony Run			1,200
Wigwam Run			1,800
Trout Run, Grays Run			1,000
Trout Run			1,000
Wolf Creek			500
Twin Rocks, Georges Pond			1,000
Tyler, Bell Hollow Creek			1,000
Sanders Run			1,000
Tyrone, California Run			1,000
Little Bald Eagle Creek			1,000
Uniontown, Meadow Run			1,000
Trout Spring			1,000
Waterville, Branch Ponds			500
Chathams Run			1,000
Lower Pine Bottom Run			500

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Waterville, Queens Run			1,000
Upper Pine Bottom Run			1,000
Wayne County, Rattlesnake Creek			1,200
West Newton, Rocky Pond			1,000
Spring Pond			1,000
Westover, Rogue Harbor Creek			1,000
Williamsburg, McAllister's pond			1,000
Piney Creek			3,000
Spring Run			1,500
Williamsport, Bertins Branch			1,000
Hagermans Run			1,000
Jones Run			1,000
Kettle Branch			1,500
Mosquito Creek			1,000
Wissahickon, Wises Mill Run			1,500
Woodbine, Orson Run			800
York, Brockie Spring Pond			1,400
Rhode Island:			
Georgiaville, ice pond			1,000
South Carolina:			
Marietta, Headwaters North Meadow and South Saluda rivers			500
Pickens, Bald Creek			800
North Saluda River			2,700
South Dakota:			
Buffalo Gap, Beaver Creek			9,800
Cascade Springs, Cascade Creek			2,000
Custer, Spring Lake			10,000
Squaw Creek			14,000
Stannums Pond			10,000
Elmore, East Branch of Spearfish Creek			20,000
Skunk Creek			10,000
Spearfish Creek			40,000
West Branch of Spearfish Creek			30,000
Englewood, Fork of Whitewood Creek			15,000
North Elk Creek			10,000
Hill City, Spring Creek			10,000
Hot Springs, Cold Brook			4,000
Keystone, Grizzley Creek			10,000
Iron Creek			10,000
Maurice, Spearfish Creek			10,000
Mystic, Castle Creek			20,000
Piedmont, Little Elk Creek			10,000
Pluma, Bear Butte Creek			30,000
Rapid City, Cleghorn Springs Pond			4,800
Crystal Springs Lake			10,000
Rochford, Little Rapid Creek			10,000
Roubaix, Elk Creek			15,000
South Fork of Elk Creek			15,000
Shannon County, Wounded Knee Creek			1,000
Sheridan, Spring Creek			10,000
Spearfish, Avery Pond			5,000
Chicken Creek			5,600
Cox Lake			5,000
Crow Creek			15,000
Driskill's pond			2,000
Freeman's pond			400
Hilton Creek			800
Lemen's pond			400
Montana Lake			5,000
Summers Creek			7,500
Watercress Creek			10,000
Sturgis, Warren Creek			20,000
Tilford, Elk Creek			20,000
West Nahant, North Fork of Little Rapid Creek			20,000
Tennessee:			
Clarksville, Blue Spring Creek			4,000
Erwin, Mill View Lake			2,000
Loves Station, South Indian Creek			20,000
Maryville, Harper's Lake			3,000
Mountain City, Mill Creek			10,000
Unicoi County, Beauty Spot Branch			6,000
Martins Creek			20,000
North Indian Creek			20,000
Rock Creek			20,000
Washington County, Knob Creek			1,600

Details of Distribution of Fish and Eggs—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Utah:			
Brigham City, applicant	30,000		
Logan, Logan River			4,000
Marysvale, Riverside Farm Creek			4,000
Ogden, Anderson's pond			2,000
Barker Company's pond			2,000
Brook Pond			2,000
Cold Water Spring			2,000
Ferrin's pond			2,000
Froerer's pond			2,000
Hillside Pond			2,000
Mountain Springs			2,000
Spring Creek			12,000
Wangsgard Spring			2,000
Winter's fish ponds			4,000
Provo, Midway Spring Creek Pond			2,000
Provo River			14,000
Salt Lake City, Stallings's pond			2,000
Vermont:			
Bartonsville, Evans Brook		10,000	
Bellows Falls, Saxtons River		15,000	2,500
Braintree, Ochers Creek		10,000	
Brattleboro, Ames, Johnson, and Newton brooks		5,000	
Cone Brook		10,000	
Chester, branches of Williams River		15,000	
Groton, Darling Pond		125,000	5,000
Island Pond, Ferrins River		30,000	1,200
Johnson, Branch of Lamoille River		5,000	
Manchester, Battenkill Creek		35,000	3,500
Montpelier, East Roxbury Pond		10,000	
Lairds Pond			1,000
Langdon Pond		10,000	
Mallory Brook		15,000	
Morrisville, Lake Mansfield		100,000	
Mountain Mills, Benney Brook		7,000	
Northfield, Meadow Brook		15,000	
Mudgett Brook		10,000	
Norton Mills, Little Leach Pond			4,500
Norwich, Lake Mitchell		125,000	5,000
Pawlet, Flower Brook		15,000	
Proctor, Pico Pond			2,500
Proctorsville, Williams River			1,500
Randolph, Ayers Brook		15,000	
Bowman Brook		6,250	
Chandler Brook		10,000	
Eldredge's pond		8,000	
Freeman's pond		10,000	
Gilead Rock Creek		10,000	
Grow Brook		10,000	
Gulf Brook		15,000	
Half Way Brook		15,000	
Howard Hill Brook		10,000	
Mafeba Lake and Brook		5,000	
Meadow Brook		12,500	
Mud Pond			2,000
Peth Brook		10,000	
Piney Brook		15,000	
Roxbury Brook		6,250	
Snows Brook		10,000	
Spears Brook		10,000	
Wellington Brook		15,000	
Richmond, Alder Brook			1,000
Roxbury, Vermont Fish Commission	50,000		
Rutland, Cold River			2,500
Furnace Brook			8,512
tributary of East Creek			1,500
Trout Brook			2,500
St. Johnsbury, Borough Brook		15,346	
Frog Pond		7,000	
Hill Top Pond		10,000	
Houghton Brook			850
Joes Brook			1,750
Lawrence's ponds			850
Lower Andrick Creek			850
Sleepers River			850
Upper Andrick Creek			850
Valley Farm Brook		5,000	
South Londonderry, Woods Brook			1,000
Taftsville, Beaver Brook		15,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings. yearlings, and adults.
Vermont—Continued.			
Townshend, Big Brook			1,500
Waterbury, Vermont Fish Commission			14,000
West Burke, Buel Brook		10,000	
West Hartford, Bugbee Sherburne Brook		15,000	
Whipple Brook		15,000	
Wilmington, Beaver Brook			1,000
Woodstock, Beaver Meadow Brook		10,000	
Curtis Brook		10,000	
Evergreen Creek		10,000	
Virginia:			
Amherst, tributary of Big Piney River			1,500
Basic City, Basic Lithia Springs			1,300
Factory Springs			1,300
Berryville, Buck Marsh			1,000
Chapel Run			500
Craigs Run			1,000
Springsbearg Run			1,000
Sprout Run			500
Big Stony Junction, Big Stony Creek			4,000
Burkeville, Elletts Pond			1,500
Clayville, Graceland Brook			1,000
Clearbrook, Turkey Run			600
Clifton Forge, Pads Creek			2,000
Smiths Creek			2,000
Wilson Creek			2,000
Cowdon, Doctors Branch		7,000	
Pettys Run		6,200	
Fairfax, Martins Branch			1,925
Harrisonburg, Dry River			3,250
Shoemaker River			1,250
Turley Branch			1,000
Hot Springs, Back Creek			1,000
Cowardin Creek			3,400
Rubino Cascade Creek			3,500
Rubino Healing Springs			15,000
Thompsons Run			2,100
Hunter, Snake Den Creek			15,000
Keswick, Ingersolls Branch			2,000
Keswick Creek			4,000
Reeds Creek			4,000
Low Moor, Karner Creek			500
Max Meadows, Mill Creek			2,000
Mechums River, Mormons River			1,000
Pond Ridge Branch			500
Stokesville, Little River			1,200
North River			1,200
Stony Run			1,200
Taylors Valley, Beaverdam Creek			10,000
Troutville, Woodvilles Branch			300
Washington:			
Bellingham, applicant	50,000		
Cheney, Rock Creek			2,400
Clarkston, Asotin Creek		5,000	
Charlie Fork Creek		3,000	
Creston, Wilson Creek			2,400
Ferry, Duck Lake			2,000
McCormick, Hilger Creek		2,000	
Newport, Thompson's pond			1,500
Plaza, Imhoff's pond			1,500
Seattle, Edenwild Lake			138
South Tacoma, Chambers Creek			148
Sumner, Salmon Springs Pond		4,500	
Tacoma, Big Marshall River		3,000	
Clover Creek		3,000	
Haskell's pond		3,000	
Rainbow Lake			296
West Virginia:			
Bartow, Headwaters of Jacksons River			1,000
South Branch			1,000
Clawson, Thorny Creek			900
Durbin, Meadow Run			15,000
Elkins, Little Black Fork Creek			12,800
Falling Springs, Blue Spring Lake			300
Glady, South Fork Grady Creek			4,050
Hambleton, Elk Lick Creek			800
Harman, Upper North Fork Creek			1,500
Hawks Nest, Freestone Pond			4,000
Horton, Gandy Creek			20,100

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
West Virginia—Continued.			
Kingwood, Laurel Run			800
Morgantown, applicant	500		
North Mountain, Talahaunche Branch			1,000
Tilehances Branch			1,000
Porterwood, Pleasant Run			12,000
Rowlsburg, Flag Run			600
Wolf Creek			600
Sitlington, Prices Branch			300
Thomas, North Fork of Blackwater River			3,600
Wisconsin:			
Alma Center, Arno Creek			1,000
Halls Creek			1,200
Stillman Branch			1,000
Town Creek			1,000
Almena, Hay River			1,000
Amherst, Howard Creek			600
Arcadia, American Valley Creek			2,300
Bennings Creek			1,300
Eagle Valley Creek			300
French Creek			1,300
Gilman Creek			2,000
Haines Creek			1,000
Holcomb Coulee Creek			400
Hunter Creek			300
Kreid Valley Creek			2,000
Long Creek			500
Louis Valley Creek			300
Mineral Spring Brook			1,000
Montana Creek			400
Muddy Creek			300
Riley Creek			2,300
Sandy Creek			300
Scharlow Valley Creek			1,400
Stony Creek			400
Trout Run			2,000
Augusta, Bridge Creek			500
Browns Creek			200
Cold Creek			200
Coon Gut Creek			300
Diamond Creek			200
Kirkhams Creek			200
Little Sand Creek			200
Piss Creek			300
Sand Creek			300
Thompson Creek			600
Travis Creek			200
Turner Creek			200
Baldwin, Kinnickinnic Creek			500
Parker Creek			300
Bangor, Adams Valley Creek			200
Big Creek			500
Burns Creek			900
Dutch Creek			500
Fish Creek			300
Sand Creek			200
Barneveld, Blue Mound Branch			500
Price Creek			200
Trout Creek			200
Walnut Hollow Creek			700
Barron, Miller Creek			800
Black River Falls, Douglas Creek			1,500
Blair, Bear Creek			800
Strum Creek			800
Vosse Coulee Creek			400
Boscobel, Seeley Creek			200
Bright, Rocky Run			1,000
Stony Creek			600
Buffalo County, Pipen Valley Creek			400
Chippewa Falls, Hatch Creek			500
Cobb, Badger Hollow Creek			200
headwaters of Blue River			500
Colby, Eden Creek			500
Porky Creek			400
South Fork of Poplar Creek			300
Colfax, Eighteen Mile Creek			2,500
Trout Creek			300
Dedham, Copper Creek			12,000
Empire Creek			12,000
Little Balsam Creek			12,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Durand, Arkansaw Creek			1,500
Edmund, Branch of Otter Creek			600
Elcho, Swamp Creek			2,500
Elk Mound, Chester Creek			300
East Fork of Trout Creek			300
Peters Creek			300
Petersons Creek			300
Trout Creek			300
Wards Branch			300
Willow Creek			300
Ellis Junction, Lower Inlet Creek			700
Elroy, Brewer Creek			1,200
Garvin Creek			1,200
Hustler Creek			400
Mile Creek			1,600
North Branch of Baraboo River			1,200
Seymour Creek			2,400
West Branch of Baraboo River			1,000
Fairchild, Hoffmans Creek			200
McLaren Creek			500
Seatts Creek			300
Whippoorwill Creek			200
Fennimore, Branch of Blue River			2,000
Green River			1,200
Fond du Lac, Parsons Creek			1,300
Fountain City, Bohris Valley Creek			1,000
Brandhorst Creek			1,000
Eagle Valley Creek			1,500
Harrison Creek			1,000
Holfel Creek			1,000
Jaegers Creek			1,000
Kellers Creek			1,000
Oak Valley Creek			1,000
Roesch Creek			1,200
Schoepps Valley Creek			1,000
Foxboro, Balsam Creek			12,000
State Line Creek			12,000
Galesville, Boon Creek			600
Dutch Creek			600
Grants Creek			600
Moose Creek			600
North Beaver Creek			1,000
Gordon, applicant	200,000		
Spring Lake			2,000
Greenwood, Norwegian Creek			300
Rocky Run			300
Hatley, Plover River			2,000
Hixton, French Creek			2,000
Hames Creek			1,000
Judgkins Creek			1,000
Mason Creek			1,000
North Branch			1,000
Pigeon Creek			2,000
Schermerhorn Creek			1,000
Sheldon Creek			1,000
Sherwood Creek			1,000
Sly Creek			1,000
Smith Creek			1,200
South Branch of Trempealeau Creek			1,200
Tank Creek			1,200
Hudson, Greenes Race			1,000
Jefferson Creek			1,000
Ten Mile Creek			1,000
Willow River			2,500
Independence, Branch of Borst Valley Creek			1,500
Branch of Traverse Valley Creek			2,000
Chimney Rock Creek			1,200
Husselgard Branch of Borst Valley Creek			2,000
Koenig Creek			800
Little Elk Creek			1,500
Plumb Creek			2,000
Traverse Valley Creek			1,500
Veum Branch of Borst Valley Creek			2,000
Wickam Creek			800
Zimmers Creek			800
La Crosse, Breidels Creek			1,000
Coon Creek			2,000
Crystal Lake			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
La Crosse, Irish Coulee Creek			1,200
Minnerts Creek			1,000
Lancaster, Austin Creek			200
Borah Creek			200
Legget Branch			200
McPherson Branch			200
Milner Branch			200
Trollope Creek			200
Walker Branch			200
Lavalle, Spring Creek			400
Lodi, Bowman Creek			1,000
Freyes Creek			1,000
Spring Creek			1,000
Menomonie, Annis Creek			1,000
Beaver Creek			1,500
Blacks Run			1,000
Boland Creek			1,000
Clack Creek			1,000
Clarks Creek			1,300
Cowan Creek			1,000
Dunkard Creek			1,000
Galloway Creek			1,000
Gilbert Creek			3,000
Grubb Creek			2,000
Halls Creek			1,000
Hay Creek			1,200
Home Farm Brook			1,000
Island Creek			2,000
Irving Creek			1,500
Jackson Creek			1,000
Johnson Creek			1,000
Lennon Creek			1,000
Little Beaver Creek			1,000
Little Elk Creek			1,500
McCarthys Branch			1,000
Otter Creek			1,000
Rock Creek			1,000
Rush Creek			1,200
Shafers Creek			1,000
Simonson Creek			1,000
Smiths Creek			1,000
Spring Creek			1,000
Sinking Creek			1,000
Stoner Creek			1,000
Thumb Creek			1,000
Torgersons Creek			1,000
Varney Creek			1,000
White Creek			1,000
Merrill, Copper Creek			3,100
Devil Creek			1,500
Newwood Creek			1,500
Pine Creek			2,500
Prairie River			600
Merrillan, Clear Creek			200
Duners Creek			200
Houghton Creek			200
Sand Creek			200
Sisna Creek			1,000
South Branch			200
South Branch of Visnoe Creek			1,000
Van Herset Creek			1,000
Midway, Half Way Creek			1,200
Millstone, Clarks Creek			2,000
South Branch of Robinson Creek			1,500
Stony Creek			1,000
Mondovi, Armer Valley Creek			400
Big Creek			400
Carroll Creek			300
Ford Creek			600
Harrison Creek			300
McDonough Creek			300
Mill Creek			1,000
Pratt Creek			300
Rosman Creek			500
Silver Creek			300
Neillsville, Mound Creek			300
New Lisbon, White Creek			1,500
New London, Nordman Creek			200
Osceola, applicant	25,000		

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Plymouth, Mullet River			1,000
North Branch of Onion River			2,500
Onion River			2,000
Port Wing, Flag River			12,000
Princeton, Snake Creek			1,000
Rice Lake, Angler Creek			1,000
Barker Creek			1,000
Big Bear Creek			1,500
Browns Creek			1,000
Cobb Creek			1,500
Cranberry Creek			1,000
Deitz Creek			1,000
Desair Creek			1,000
German Creek			1,200
Hay River			2,000
Heckey Creek			1,500
Hemlock Creek			1,000
Little Bear Creek			1,500
Little Scobia Creek			1,000
Little Spring Creek			1,000
Lost Creek			1,000
Meadow Creek			1,200
Miller Creek			1,500
Mud Creek			1,000
Overby Creek			1,000
Pigeon Creek			1,000
Pokegama Creek			2,000
Prairie Creek			1,200
Renville Creek			1,000
Rice Creek			1,000
Rock Creek			1,500
Rocky Canon Creek			2,000
Savage Creek			1,000
Silver Creek			1,200
South Creek			1,000
Spoon Creek			1,000
Spring Creek			1,000
Spur Nine Creek			1,000
Sucker Creek			1,000
Tescobia Creek			1,000
West Branch of Rock Creek			1,000
Yellow River			1,500
Richland Center, Ash Creek			1,000
Bear Creek			2,000
Brush Creek			1,000
Camp Creek			1,000
Fancy Creek			1,200
Grinsells Branch			1,000
Hawkins Creek			1,000
Leatherburgs Branch			1,000
Little Willow Creek			1,000
Melancthon Creek			1,500
Mill Creek			2,000
Soules Creek			1,000
South Branch Pine River			1,000
West Branch Pine River			1,000
Willow Creek			1,200
Ridgeway, Henstock and Lane creeks			200
Henstock and Strutt creeks			200
Rosendale, Boyds Creek			200
Willow Creek			1,200
Rusk, Mud Creek			500
Scovills Crossing, Rock Creek			500
Sparta, Beaver Creek			300
Big Creek			400
La Crosse River			600
Silver Creek			400
Soper Creek			400
Squaw Creek			400
Walroth Creek			400
Walworth Pond			1,000
Spring Valley, Burghart Creek			200
Cady Creek			400
Eau Galle Creek			800
French Creek			200
Lohn Creek			200
Lousy Creek			300
Mines Creek			200
North Gilbert Creek			300

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Spring Valley, Rush Creek			1,000
South Gilbert Creek			200
Stitzer, Davis Branch			200
Legett Branch			300
Wagner Branch			300
Taylor, Curran Creek			2,000
French Creek			1,500
Low Creek			2,000
Pine Creek			1,500
Skutley Creek			2,000
Vassar Creek			2,000
Thorp, Sterling Creek			1,200
Trempealeau County, Holcomb Coulee Creek			400
Norway Coulee Creek			300
Pine Creek			300
Tamarack Creek			400
Viroqua, Beabout Creek			1,000
Bishop Creek			1,400
Brookville Creek			400
Brush Creek			400
Bunch Creek			1,000
Cedar Run			400
Coe Creek			1,000
Elk Run			400
Getter Branch			1,600
Harrison Hollow Creek			400
Hornby Creek			1,400
Jenson Branch			1,000
Meadow Brook			400
Pine Hollow Creek			1,400
Primers Branch			1,000
Root Branch			1,000
Seeys Branch			1,000
Sidie Creek			400
Springville Branch			1,200
Towerville Branch			400
Weber Creek			1,000
West Branch of Kickapoo Creek			600
Waldo, Briggs Creek			200
Warrens, Lemonweir Creek			1,000
North Branch of Lemonweir Creek			2,000
Waupaca, Dayton Brook			400
Emmons Creek			1,800
Wautoma, Basin Creek			400
White River			6,000
Westby, Bad Axe Creek			400
Bishop Creek			400
Branch of Bad Axe Creek			1,000
Dixon Spring			1,000
East Branch of Coon Creek			1,400
Knapp Creek			400
Minor Creek			400
Otter Creek			800
Paulsrud Creek			400
Rogster Creek			1,000
Sanghus Creek			1,000
Sees Creek			400
Shreve Creek			1,000
South Branch of Timber Coulee Creek			1,000
Spring Valley Creek			400
Timber Valley Creek			400
Tveidts Spring			1,000
Von Ruden Creek			1,000
West Branch of Kickapoo Creek			3,000
Westfield, McGinnis Creek			500
West Salem, Barckly Creek			1,000
Gills Coulee Creek			200
Johnson Creek			1,000
Jones Creek			200
Kundson Creek			1,000
Larsons Coulee Creek			200
Luce Creek			10,000
McEldowney Creek			200
Martin Creek			1,000
Osborn Creek			1,000
Ruland Creek			200
Sam McKinley Creek			200
Scotch Coulee Creek			200
Storandt Creek			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
West Salem, Walker Creek			1,000
Weston, Dennings Springs			1,000
More Creek			1,000
Wheeler, Big Beaver Creek			2,000
Big Otter Creek			1,200
Blanks Creek			1,000
La Forge Creek			1,000
Little Otter Creek			1,000
Whitehall, Beaver Creek			300
Bruce Valley Creek			800
Chimney Rock Creek			800
Elk Creek			400
Fly Creek			1,100
Hay Creek			200
Irvine Creek			800
North Branch of Elk Creek			400
North Creek			300
North Valley Creek			600
Pigeon Creek			2,200
Rue Creek			600
Rumpel Creek			200
Russel Creek			300
York Creek			300
Wilton, Beecher Creek			1,000
Cold Springs Creek			1,000
Dorset Creek			1,000
Miller Creek			1,000
Withee, Woody Creek			1,000
Wyoming:			
Beulah, Sand Creek			25,000
Cheyenne, Granite Spring Reservoir			6,000
Cokeville, Smith Fork of Bear River			3,000
Kemmerer, Carter Creek			1,800
Hams Fork of Green River			1,800
Shell, Shell Creek			15,000
Trappers Creek			15,000
Sheridan, Cold Spring Pond			8,000
Parker's Spring Pond			8,000
Patrick's Lake			1,000
Piney Spring Pond			400
Sand Pond			399
Spring Creek			600
Yellowstone National Park, Indian Creek			34,000
Willow Creek			63,800
Total[a]	921,237	5,434,302	3,504,348

[a] 90,426 fry and 12,762 fingerlings were lost in transit.

SUNAPEE TROUT.

State, locality, and disposition.	Fry.
New Hampshire:	
Lake Sunapee, Lake Sunapee	213,163

GRAYLING.

State, locality, and disposition.	Eggs.	Fry.
California:		
Sisson, California Fish Commission	100,000	
Montana:		
Belton, Lake Five		50,000
Bozeman, Bozeman Creek		50,000
Browns, Rock Creek		24,000
Gallatin County, Bozeman Creek		50,000
Bridger Creek		130,000
East Gallatin River		80,000
Lyman Creek		25,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

GRAYLING—Continued.

State, locality, and disposition.	Eggs.	Fry.
Montana—Continued.		
Gallatin County, Stone Creek		50,000
West Gallatin River		50,000
Great Falls, Smith River		50,000
Madison County, Cliff Lake		98,000
Elk Creek		757,000
Hidden Lake		14,000
Picnic Creek		97,200
Redrock Creek		200,000
Maiden Rock, Big Hole River		24,000
Missoula, Bitter Root River		25,000
New Hampshire:		
Lake Sunapee, Lake Sunapee		40,000
Wyoming.		
Sheridan, Wyoming Fish Commission	100,000	
Total [a]	200,000	1,814,200

[a] 2,000 fry were lost in transit.

PIKE.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Wisconsin:	
La Crosse, Mississippi River	8,000

CRAPPIE AND STRAWBERRY BASS.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Arkansas:	
Corning, Corning Lake	300
Greenwood, Maple Grove Pond	100
Magnolia, Wyrick's pond	200
Pocahontas, Spring Lake	100
Russellville, Brooks's lake	50
Illinois:	
St. Clair County, Webers Lakes	350
Shepherd, Sni Ecarte River	400
Indiana:	
Plymouth, Dixon Lake	422
Pretty Lake	422
Winona Lake, Winona Lake	421
Indian Territory:	
Ardmore, Brown's pond	50
Chickasaw Conquest Pond	50
Hickory Creek	50
Oaklawn Lake	35
Walnut Bayou	50
Tishomingo, Big Blue River	180
Iowa:	
North McGregor, Mississippi River	7,000
Kansas:	
Anness, Gawthrop's pond	100
Knowlton's pond	100
Attica, Campbells Springs	100
Eldorado, Walnut River	200
Halsted, Chapin's pond	100
Hutchinson, Webster's pond	100
Pratt, Jones's pond	100
Mississippi:	
Booneville, Booneville Lake	[a]700
Macon, Loch Loman	500
Missouri:	
Foley, King's lake	300
Horine, Windsor Lake	350
Lebanon, Draper's pond	100
Richland, Silver Lake	200
St. Louis, Dellman's pond	350
Schilling's pond	42
Wappapello, St. Francis River	400
New Mexico:	
Portales, Pendergraft's pond	50
Roswell, artesian reservoir	100
Berrenda Lake	60
Leland Pond	50
New York:	
Riverdale, Steiner's lake	140
Ohio:	
Chippewa Lake, Chippewa Lake	250
Cleveland, Lake Fairbanks	200
Oklahoma:	
Ames, Sturgeon's pond	100
Bison, Baker's pond	100
Cache, Cache Creek	300
Chandler, McRay's pond	50
Crescent, Cedar Glen Pond	100
Kelley's pond	100
Kendrick's pond	100
Dover, Groenewald's pond	100
Fallis, Lake Hamel	100
Guthrie, Dale's pond	50
Ellison's lake	125
Island Park Lake	50
Twin Lakes	75
Hennessey, Cottonwood Creek Pond	215
Indiahoma, Wagner Pond	100

[a] These were fry.

Details of Distribution of Fish and Eggs—Continued.

CRAPPIE AND STRAWBERRY BASS—Continued.

State, locality and disposition.	Fingerlings, yearlings, and adults.
Oklahoma—Continued.	
Lovell, Elrod's pond	100
Newkirk, railroad reservoir	150
Perry, Walker's pond	175
Shattuck, Ivanhoe Lake	160
Stillwater, Chandler's pond	50
Labyer's reservoir	150
Pennsylvania:	
Doylestown, Delaware River	15
Tohickon Creek	15
Texas:	
Annona, Snow Lake	20
Austin, Hughes's pond	10
Peaceful Valley Lake	10
Phillips Lake	20
Dodd City, Oil Mill Lake	20
Graham, Ernest's lake	35
Graham Pond	35
Morris's pond	35
Phillips Lake	35
Greenville, Crush Lake	70
Texas—Continued.	
Kaufman, Bruton Lake	20
City Pond	50
Farm Lake	30
Love Lake	30
Taylor's pond	30
Weggenton's pond	20
Kyle, Spring Lake	10
Paris, Red Hill Pond	20
San Antonio, Well Lake	50
Sherman, Fallen's pond	10
Lakeview Lake	20
Winnsboro, Morris's pond	20
Rhodes's pond	35
West Virginia:	
Holly Junction, Elk River	250
Wisconsin:	
La Crosse, Mississippi River	8,000
Total[a]	26,137

[a] 456 fingerlings were lost in transit.

ROCK BASS.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Arizona:		
Holbrook, reservoir		100
Wilcox, Cameron's pond		100
Williams, Howard Lake		300
Arkansas:		
Fort Smith, Stoufer's pond		100
Havana, Moral Spring Pond		100
Hot Springs, Walnut Grove pond		100
Little Rock, Dickinson's Pond		100
Indiana:		
Albion, Long Lake		300
Pleasant Lake		300
Andrews, Keeners Pond		100
Kimmel, Round Lake		300
Winona Lake, Winona Lake		500
Indian Territory:		
Ardmore, Thurman's gin pond		250
Caddo, Dunlap's pond		100
Chichasha, Frank's pond		100
Durant, Sylvan Lake		100
Lindsay, Tickapoo Springs		100
Marlow, Jones Pond		100
Sessum Pond		100
Milburn, Sharp's pond		150
Roff, Rod and Gun Club Lake		200
Iowa:		
Bussey, Clearwater Pond		100
Clutier, Dvorak's pond		200
Simonsen's pond		300
Donnellson, Klingler's pond		100
Eldridge, Engle's pond		300
Pleasant Plain, Macy's pond		100
Kansas:		
Ashland, Berryman's pond		200
Aurora, Herbert's pond		150
Blaine, Valberg's pond		100
Bendena, Howard's pond		100
Bronson, Freeman's pond		100
Burrton, Greenfield's pond		100
Cherryvale, Blaes Pond		100
Kansas—Continued.		
Ellinwood, Koehler's pond		100
Greenleaf, Petersen's pond		125
Hutchinson, Durand's pond		100
Webster's pond		100
Kendall, reservoir		100
Kensington, Kensington Pond		125
Kimball, Roseland Reservoir		100
Larned, Elm Lake		100
Keller's pond		100
Leoti, Blue Pond		100
Klapperthal Pond		100
Long Pond		100
reservoir		100
Round Pond		100
McCune, Larcom's pond		150
Madison, Reynolds's pond		100
Moline, Spray's pond		100
Ness City, Clouston's pond		100
Penokee, Kobler's pond		150
Plainville, Lemon's pond		100
Seefeld's pond		150
South Haven, Reid's pond		100
Topeka, White's pond		100
Valley Center, Hohman's pond		100
Vermilion, Bergmann's pond		125
Wilsey, Robinson's pond		125
Maryland:		
Emmitsburg, Stonehurst Lake	100	
Missouri:		
Beaverton, Sinking Creek		200
Independence, Cedar Lawn Lake		200
Kirk's lake		100
Kansas City, Hagerman's pond		100
Neosho, Carter's pond		140
New Jersey:		
Williamstown, Collins Lake	100	

Details of Distribution of Fish and Eggs—Continued.

ROCK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
New Mexico:		
Artesia, Waltercheid's pond		100
Corona, Gremble's pond		200
Deming, Casa Alma Pond		100
Clondike Pond		125
Garr's pond		100
Hall's pond		100
Hodgdon's pond		100
Hughes Pond		100
Louis's pond		150
reservoir		300
Dorsy, Hendel's pond		125
Manuelito, Little Pond		100
Nara Visa, Agna Caballo Pond		100
Nutt, Ringer's pond		100
Portales, Bradley's pond		100
Gregory's pond		65
Harris's pond		100
Martin's pond		65
Pendergast's pond		100
Vencio's pond		100
Roswell, Bottomless Lake		460
Santa Rosa, Blue Hole Lake		200
New York:		
Rockville Center, Wright's pond	200	
North Carolina:		
Bessemer City, Durham's pond	100	
Burlington, Willow Brook	200	
High Point, Pierce's pond	100	
King, Petree's pond	100	
Louisburg, Dean's pond	100	
Macon, Felt's pond		150
Nashville, Whitley's pond	100	
Newells, Newell's pond		100
Raleigh, Mahler's pond	150	
Ruffin, Hostlers Creek	200	
Spring Hope, Sopoina Pond		200
Stoneville, Roberts's pond	100	
Stovall, Lewis's pond	100	
Wadesboro, Moore's pond		100
Waynesville, Campbell's pond	100	
Winston Salem, Brown's pond		100
North Dakota:		
Havana, Lunsted's pond		200
Ohio:		
Chippewa Lake, Chippewa Lake		400
Columbus, Walhalla Pond		100
Fremont, Sandusky River		300
Hanover, Fern Pond		100
Holmesville, McCune's lake		100
Hubbard, Kerr's pond		150
Rossville, Felkey's pond		100
Oklahoma:		
Ames, Dixon's pond		100
Sturgeon's pond		250
Apache, Clancy's pond		100
Arapahoe, Mornk's pond		100
Blackwell, Koenig's pond		100
Cache, Cache Creek		600
Chandler, McRay's pond		50
Comanche County, Darnall's lake		100
Crescent, Kelley's pond		100
Wolf's pond		100
Doxey, Cottonwood Pond		100
Parks's pond		100
Eldorado, Perry's pond		100
Elgin, Allison's pond		200
Elk City, Conley's pond		100
Enid, King's lake		250
Erick, Miller's lake		100

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Oklahoma—Continued.		
Fay, Whirlwind Pond		100
Geronimo, Arnold's pond		150
Saddle Crest Pond		100
Guthrie, Dale's pond		50
Douglas's pond		100
Highland Park Lake		50
Jenkins's pond		100
Johnson's lake		75
Guymon, Frisco River		100
Indiahoma, Jack Creek Pond		100
Jefferson, Hawes's pond		100
Kingfisher, Percell's reservoir		200
Lawton, Roseland Pond		200
Woodlawn Lake		100
Medford, Burns's lake		100
Newkirk, railroad reservoir		300
Ora, Hall's pond		100
Yeaman's pond		100
Pawnee, Walker's reservoir		100
Quinlan, Mansfield's pond		100
Sayre, Thompson's lake		265
Shattuck, Ivanhoe Lake		100
Stillwater, Chandler's pond		50
Labyer's reservoir		125
Yost Lake		400
Temple, Kuhlman's pond		100
Texhoma, Hodges's pond		100
Pottinger's pond		100
Tyrone, Hubers Pond		100
Massie's pond		100
Wheatland, Novotny's pond		100
Thompson's pond		100
Yukon, Carson's pond		100
Newman's pond		100
Pennsylvania:		
Ashland, Pine Creek	200	
Bryn Mawr, Verner's pond	100	
Penllyn, Park Creek	200	
Yardley, Bleachery Pond	100	
South Carolina:		
Duncans, Greer's pond		100
Gaffney, Irene Pond		100
Laurens, Lucas's pond		100
Smith's pond		100
Simpsonville, Leopard's pond		100
Spartanburg, Arkwright Mills reservoir		100
Windsmith Creek		100
Walterboro, Centerville Lake		100
Tennessee:		
Clarksville, Tyler's pond		100
Luttrell, Bull Run Pond		100
Texas:		
Amarillo, West Amarillo Creek		200
Austin, Durham's pond		20
Avery, Big Pool		40
Medford's pond		40
Bonham, Bramlett's pond		40
Bryson, Caldwell's pond		40
Canyon City, Palo Duro Canyon Creek		500
Carmine, Emmerich's pond		30
Clarendon, Chamberlin's pond		70
Clarksville, Owen's pond		50
Claude, McClendon's pond		20
Collinsville, Akridge's pond		100
Reed's farm pond		20
Dalhart, McCleskey's pond		50

Details of Distribution of Fish and Eggs—Continued.

ROCK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Texas—Continued.		
Denton, Philanthropy Lake		50
Detroit, Crittenden's pond		30
Griffis Pond		40
Turner's pond		40
Elgin, Lundgren Pond		40
Straus's pond		20
Fort Worth, Booty's pond		40
Lake Como		300
Granbury, Clapp's pond		30
Grand Saline, Salt Company's pond		50
Greenville, Hills Park Pond		30
Honey Grove, Lynn's pond		40
Houston, Helbig's pond		40
Manchaca, Carpenter's pond		40
Marshall, Katrine Pond		50
Mesquite, Mesquite Gin Company's pond		50
Miami, Cattle Company's Pond No. 9		40
Pasadena, Lake Remonia		70
Pilot Point, Newton's lake		150
Stephenville, McClenny's pond		30
Stratford, Amend's pond		30
Terrell, Ables and Walton ponds		100
Breeden's pond		20
Brin's pond		30
Dashler Pond		200
Jarvis's pond		150
Lawrence's pond		30
O'Conner Lake		150
Sanitarium Pond		40
Vernon, Muller's pond		100
Waelder, Miller's pond		40
Wheeler County, Windmill Pond		20
Wichita Falls, Lake Wichita		500
Virginia:		
Axton, Leatherwood Pond	100	
Beaverdam, Luck's pond	100	
Branchville, artesian pond	92	
Burkeville, Lily Pond	100	
Virginia—Continued.		
Byrdville, Fitts's pond	100	
Charlottesville, Gordon's pond	100	
Chatham, Kirby's pond	100	
Crewe, Fraser's pond	100	
Critz, Mill Creek Lake	200	
Danville, Cotton Mills Lake	350	
Dublin, Glenwood Pond	100	
Ford's Depot, Hill's Mill Pond	200	
Freeman, Harris's pond	100	
Gate City, Elliott's pond	100	
Guiney's, Blanton's pond	100	
Hanover, Sneads Pond	100	
Harrisonburg, Cooks Creek		300
Long Glade Creek		300
Lacrosse, Smith's fish pond	100	
Lexington, Sheridan's pond		150
Louisa, Daniel's pond		225
Gooch's pond	200	
Oakhurst Pond	100	
Martinsville, Drunken Spring	100	
Mineral, Oakwood Pond	100	
Richmond, Johnson's pond	400	
Turner's pond	100	
Via Lake	150	
Windsor Pond	100	
Yaleys Pond	200	
Ringgold, ice pond		100
Lindsey's pond	100	
Ruther Glen, Agy's pond	100	
Somerset, Garnett's pond	100	
Yager's pond	100	
Swoope, Middle River		325
Thaxton, Freestone Pond	100	
Wyndall, Spring Creek Pond	100	
West Virginia:		
Parkersburg, Goff's pond		150
Wisconsin:		
La Crosse, Mississippi River		3,000
Total[a]	6,542	30,305

[a] 208 fry and 97 fingerlings were lost in transit.

WARMOUTH BASS.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Georgia:	
Buena Vista, Hollis Lake	125
Cairo, Hair Branch	100
Columbus, Shorter Pond	45
Maryland:	
Lanham, Temple's pond	100
New Jersey:	
Iselin, Kuntz's pond	52
Texas:	
Bryan, College Pond	80
Fin and Feather Club Pond	100
Colorado, Morrison's pond	10
Commerce, Jernigan's pond	20
Devine, Whitfield's pond	40
El Paso, Smith's lake	80
Enloe, Haygood's pond	40
Ft. Worth, Murphey's pond	40
Gainesville, Bruce's pond	20
Savage's pond	40
Greenbrier, Greenbrier Lake	70
Lakewood Lake	70
Texas—Continued.	
Greenville, Foster's pond	30
Hubbard, Vickery's pond	20
Walton's pond	20
Josephine, Reese's pond	50
Kaufman, Farm pond	110
Shaw's pond	80
Loraine, Matthews's lake	10
Mexia, Pitman's pond	30
Midland, Clabber Hill Pond	40
Ingham's pond	20
Monahans, reservoir	30
Moore, Winter's pond	20
Mount Calm, Bronaugh Pond	20
Nocona, railroad reservoir	30
Odessa, Pegue's pond	50
Roanoke, Goodfellow's pond	50
San Antonio, Wallace's reservoir	50
Tyler, Greenbrier Lake	120
Total[a]	1,812

[a] 48 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

SMALL-MOUTH BLACK BASS.

State, locality, and disposition.	Fry.	Finger-lings, year-lings, and adults.
Alabama:		
Jasper, Clear Creek	....	200
Connecticut:		
Derby, Housatonic River	2,000	....
Portland, Job Pond	2,000	....
Waterbury, Quasepaug Lake	2,000	....
Georgia:		
Greensville, Chattahoochee River	....	50
Indiana:		
Angola, Bass Lake	....	300
Lake James	....	1,200
Snow Lake	....	300
Bass Lake, Bass Lake	....	300
Bloomfield, Richland Creek	....	225
Columbia City, Loon Lake	....	250
Shriner Lake	....	250
Indianapolis, Fall Creek	....	225
Sugar Creek	....	225
White River	....	225
Logansport, Gravel Pit Lake	....	250
New Albany, Terstegge's pond	....	225
Pendleton, Fall Creek	....	225
Peru, Eel River	....	300
Ray, Clear Lake	....	250
Rochester, Tippecanoe River	....	250
Valparaiso, Flint Lake	....	250
Vincennes, Robinson's lake	....	225
Wawassee, Wawassee lake	....	500
Winamac, Tippecanoe River	....	250
Kentucky:		
Bowling Green, Barren River	....	550
Trammill Creek	....	1,125
Cadiz, Little River	....	225
Danville, Dix River	....	225
Glencoe, South Side Pond	....	100
Richmond, Lake Reba	....	200
Sparta, Gayles Slough	....	150
Maryland:		
Big Pool, Big Pool	1,500	....
Michigan:		
Brighton, Ore Lake	....	200
Corunna, Shiawassee River	....	300
Dowagiac, Cable Lake	....	400
Ellsworth, Benways Lake	....	300
Lake Bowers	....	300
Lake St. Clair	....	300
Six Mile Lake	....	300
Wilson Lake	....	300
Hillsdale, Baw Beese Lake	....	600
Hopkins, Baker Lake	....	400
Lawrence, Baker Lake	....	400
Lake George	....	400
Plopenduks Lake	....	400
Reynolls Lake	....	400
Leslie, Berry Lake	....	500
Long Lake, Long Lake	....	400
Marshall, Grace Lake	....	400
Oden, Crooked Lake	....	650
Orchard Lake, Straits Lake	....	625
Peacock, Sable Lakes	....	300
Pentoga, Chicagoan Lake	....	400
Pinconning, Pinconning River	....	250
Pontiac, Cass Lake	....	500
Portage, Hampton Lake	....	400
Rose Center, Buckhorn Lake	....	400
Saint James, Font Lake	....	300
Saline, Arnolds Lake	....	600
Sidnaw, Mead Lake	....	200
Stark, Meining's pond	....	200
Traverse City, Boardman Lake	....	300
Turtle, Long Lake	....	400
West Branch, Edwards Lake	....	400

State, locality, and disposition.	Fry.	Finger-lings, year-lings, and adults.
Minnesota:		
Alexandria, Carlos Lake	....	200
Lake Geneva	....	300
L'Homme Dieu Lake	....	200
Dorset, Mantrap Lake	....	200
Willmar, Eagle Lake	....	200
New Hampshire:		
Keene, Spofford Lake	1,500	....
Meredith, Waukeman Lake	3,000	....
West Ossipee, Lake Ossipee	3,000	....
West Thornton, Merna Lake	....	250
Whitefield, Montgomery Lake	2,000	....
New York:		
Broadalbin, Keneyette Creek	1,500	......
Cambridge, Lake Lauderdale	3,000	....
Thurber's pond	3,000	....
Greenwich, Cossayuma Lake	3,000	....
Lake George, Lake George	3,500	....
Schenectady, Sweet Hill Lake	1,500	....
Shushan, Hedge's lake	3,000	....
Troy, Hudson River	2,000	....
Reichards Lake	2,000	....
Tupper Lake, Tupper Lake	2,000	....
North Carolina:		
Wadesboro, Brown Creek	2,000	....
Winston Salem, Brown's pond	....	150
North Dakota:		
Jamestown, Spiritwood Lake	....	250
Ohio:		
Barberton, Lake Anna	....	300
Columbiana, Mill Creek Dam	....	100
Dayton, Stillwater River	....	400
Gambier, Kokosing River	....	300
Milford, Little Miami River	....	450
Otway, Brush Creek	....	300
Oklahoma:		
Cache, Medicine Creek	....	100
Pennsylvania:		
Athens, Susquehanna and Chemung rivers	2,000	....
Granite, Conowago Creek	1,500	....
Lock Haven, West Branch of Susquehanna River	2,000	....
Mill Hall, Bald Eagle Creek	2,000	....
Minersville, Roarsville Dam	....	280
Moscow, Lake Henry	3,000	....
Reading, Tulpehocken Creek	....	280
Towanda, Susquehanna River	2,000	....
Towanda Creek	4,000	....
Wysox Creek	2,000	....
Wyalusing, Susquehanna River	2,000	....
Rhode Island:		
Wakefield, Silver Lake	2,800	......
Woonsocket, Troustone Reservoir	800	....
Tennessee:		
Big Creek, Holston River and Big Creek	3,000	....
Oakdale, New River	2,000	....
Vasper, Little Cove Creek	2,000	....
Vermont:		
Ludlow, Echo Lake	2,000	....
Montpelier, Groton Pond	3,000	....
Morrisville, Lake Elmore	2,000	....
Randolph, Cobb Pond	2,000	....
West Danville, Joe's pond	3,000	....
Virginia:		
Abingdon, Little Fork of Holston River	....	200

Details of Distribution of Fish and Eggs—Continued.

SMALL-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Virginia—Continued.		
Fishers Hill, Shenandoah River	1,500	
Mount Jackson, North Fork of Shenandoah River	1,500	
Remington, Rappahannock River		94
Saltville, North Fork of Holston River		200
Strasburg, West Fork of Shenandoah River	1,500	
West Virginia:		
Clarksburg, West Fork of Monongahela River	4,000	
West Virginia—Continued.		
Harpers Ferry, Potomac River	1,500	
Little Falls, Monongahela River	6,000	
Wisconsin:		
Elcho, Bass Lake		200
Elkhart, Elkhart Lake		115
Fifield, South Fork of Flambeau Creek		200
Vilas County, Palmer Lake		300
Total[a]	102,600	26,844

[a] 40,000 fry and 1,026 fingerlings were lost in transit.

LARGE-MOUTH BLACK BASS.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Alabama:		
Andalusia, Hicks' pond		1,800
Knowles Mill Pond		2,600
McIntosh Mill Pond		900
Anniston, Cane Creek		1,000
Coldwater Creek		1,000
Hillabee Creek Pond		1,000
Oxford Lake		1,000
Attalla, Big Wills Creek		1,500
Clear Creek		1,500
Bear Creek, Big Bear Creek		150
Birmingham, Birmingham Reservoir		1,800
Lake Como		900
Lakeview Lake		2,600
Brundige, Spring Creek Pond		1,000
Buffalo, Osaligee Creek		2,000
Castleberry, Noel Pond		1,000
Cedar Bluff, Chattooga River		1,500
Spring Creek Mill Pond		1,000
Courtland, Big Nance Creek		274
De Kalb County, Lookout Creek		1,300
Elba, Lake Elba		1,000
Whitewater River		1,000
Enterprise, Turner's pond		1,000
Eoline, Hubbard's pond		160
Estelle, Lambert's pond		200
Sharp's pond		200
Ethelsville, Hancock's pond		150
Eufaula, Harrison Pond		1,000
Fayette, Bankhead Pond		150
Florala, Lake Jackson		2,000
Gadsden, Dunaway's pond		1,800
Geneva, Choctawhatchee River		1,800
Greenville, Coker's pond		1,000
Hanceville, Mulberry Fork of Blackwater River		1,500
Parker's pond		300
Hartford, Crapps Pond		1,000
Hartselle, Flint Creek		1,000
Headland, Bird Fish Pond		1,000
Huntsville, Merrimack Lake		1,000
Jasper, Clear Creek		300
Kennedy, Cow Branch		300
Leeds, East Cahaba Creek		2,500
Mobile, Lake Huricosco		1,000
Pine Apple, Bear Creek Pond		200
Portersville, Ryan's pond		200
Alabama—Continued.		
Prattville, Chambliss Pond		160
Randolph, Spring Lake		1,000
Roanoke, High Pine Creek Pond		1,200
Roden, Fork of Blackwater River		1,800
Sanford, Henderson's pond		900
Snow Hill, mill pond		200
Springville, White's pond		300
Troy, Carpenter's pond		1,000
Youngblood's pond		1,000
Tuscaloosa, Lake Artesia		150
Whatley, Hill Spring Branch		160
Arizona:		
Adamana, Truax Reservoir		125
Flagstaff, Lake Murray		250
Ft. Thomas, Goodwin Reservoir		200
Hereford, Cobbe's reservoir		125
Patagonia, Sonovita Creek		150
Safford, Reservoir		100
Williams, Red Lake		150
Arkansas:		
Antoine, Kirkham's pond		100
Camden, Branch Pond		125
Webb Lake		200
Cushman, Kettler's pond		125
Elliott, Cross's pond		150
Hope, Bodcaw Creek		100
Lake Village, Lake Chicot		200
Magnolia, Allen Pond		175
Morrillton, Stallings's pond		125
Pine Bluff, Allen's lake		100
Stamps, Bodcaw ponds		300
Colorado:		
Boulder, Glacier Lake		375
Canon City, Sell's lake		125
Greeley, Hodgell's lake		375
Larkspur, Perry Park Lake		375
Springer's reservoir		375
Walsenburg, Reservoir No. 1		250
Delaware:		
Houston, Wilson's pond		200
Wilmington, Brandywine Creek		300
District of Columbia:		
Off Fish Ponds, Potomac River		22
Florida:		
Lake Butler, Lake Butler		2,000
Ocala, Brickyard Pond		2,000
Santos, Brookside		2,000
Sisco, Spring Lake		2,000

Details of Distribution of Fish and Eggs—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Georgia:		
Amsterdam, Bedinger Lake		1,000
Deli Lake		1,000
North Lake		1,000
Atlanta, Conley's pond		800
East Lake		800
Roswell Lake		500
Athens, Middle Oconee River		150
Barnesville, Marshburn's lake		4,000
Berzelia, McCormick Mill Pond		1,000
Blue Ridge, Green Pond		2,000
Box Springs, Lake Mohignac		3,000
Buchanan, Big Creek Pond		1,000
Cedartown, Benedict Pond		1,000
Lake Creek		1,000
Lake Juliet		1,000
Lime Branch		1,000
mill pond		1,000
Reeds Branch		1,000
Tanyard Branch		1,000
Rest Pond		1,000
Columbus, St. Elmo Lake		1,000
Crawfordville, Jordan's Mill Pond		1,000
Dalton, Bitting Branch		1,000
East Point, Connally's pond		1,000
Eatonton, Hunt's pond		2,000
Jenkin's pond		1,000
Lick Creek		1,000
Little River		1,000
Fisk, Fish Creek		2,400
Gainesville, Mulberry River		150
Grantville, Hosiery Mill pond		1,000
Greensboro, Pannell Pond		1,000
Greenville, Moffett Bros'. pond		1,000
Hillsboro, Cedar Creek		2,000
Wynens' pond		600
Jackson, McCords' Mill Pond		1,400
Leslie, Hurd Pond		1,000
Lewisville, Little's pond		1,000
Macon, Ocmulgee River		3,000
Marietta, Lake McKenzie		1,000
Paschal, Lake Ransom		1,000
Pelham, Pelham Pond		1,000
Ringgold, East Chickamauga Creek		2,000
Hacketts' pond		1,000
Middle Chickamauga Creek		1,500
Robinson's pond		200
Rochelle, Mill Pond		1,000
Rome, Barnett's Mill Pond		1,000
Wrights' Mill Pond		1,000
Round Oak, Orchard Lake		2,000
Sandersville, Boiling Spring Pond		1,000
Soperton, Bobtail Creek		1,000
Stone Mountain, Spring Water Pond		1,000
Summerville, Chattooga Creek		2,000
The Rock, Stafford's pond		1,000
Thomaston, Auchumpkee Creek		1,000
Valdosta, Converse's pond		1,000
Walker County, Freen's lake		2,000
White Plains, Bonner Creek Pond		1,000
Yatesville, Ayer's pond		500
Illinois:		
Antioch, Catherine Lake		200
Channel Lake		500
Lake Marie		250
Petite Lake		300
Illinois—Continued.		
Ashland, Stribling's pond		100
Barrington, Lake Zurich		300
Rundell Lake		100
Cameron, Nelson's pond		100
Carlinville, Burgdorff's lake		120
Chrisman, Sommerville's lake		180
Clayton, Parn's pond		70
Zeiger's pond		70
Crystal Lake, Crystal Lake		220
Decatur, Moffitt's lake		90
Earlville, Conklin's lake		100
East St. Louis, Bluff Side Lake		200
Elgin, Fox River		300
Freeport, Pecatonica River		100
Galesburg, Pankey's pond		125
Geneseo, Green River		200
Joliet, Hickory Creek		150
Hobb's pond		100
Kewanee, Glen Oak Lake		100
Lake Villa, Cedar Lake		500
Lake Villa, Sand Lake		100
Lemont, Walker's quarry pond		100
Long Lake, Long Lake		400
Manhattan, Bickford's pond		125
Marengo, Metcalf's pond		200
Markham, Rankin's pond		30
Meredosia, Meredosia Bay		250
Naperville, Quarry Pond		200
Oneida, Thayer's lake		100
Ottawa, Fox River		200
Pekin, City Park Pond		400
Plainville, Du Page River		200
McKenna's pond		100
Richmond, Twin Lakes		200
Riverside, Walker's pond		100
Rockefeller, Diamond Lake		300
Round Lake, Round Lake		800
St. Clair County, Webers Lake		150
Sherman, Orchard farm pond		30
Springfield, Iles Bros'. lake		90
Waterloo, Beaver Lake		30
Bissell Lake		30
Island Lake		30
Lake Bartlett		30
Woodhull, Lowry's pond		100
Indiana:		
Albion, Blackman's lake		200
Gilbert Lake		200
Silver Lake		200
Smalley Lake		200
Bremen, Lake of the Woods		150
Plymouth, Twin Lakes		85
Walkerton, Koontz Lake		400
Indian Territory:		
Hanson, Gilbert's pond		125
Winchester Pond		100
Muskogee, Barren Fork of Illinois River		200
Vann's lake		150
Tahlequah, Illinois River		2,000
Vinita, Bull Creek		1,000
Iowa:		
North McGregor, Mississippi River		2,000
Kansas:		
Anthony, Silver Creek		200
Bluff City, Walta's pond		100
Cairo, Gould Lake		175
Clifton, Skating Pond		455
Collyer, Saline River		125
Columbus, Spring Lake		1,000
Council Grove, Neosho River		500
Cuba, Skocny's pond		185

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.	State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Kansas—Continued.			Michigan—Continued.		
Emporia, Cottonwood River		250	Sallings, Otsego Lake		250
Englewood, Bullard Lake		125	Traverse City, Boardman Lake		300
Enterprise, Smoky Hill River		300	Carp Lake		300
Fredonia, La Dow's lake		150	Long Lake		400
Galesburg, Inland Lake		150	Minnesota:		
Labette Creek Pond		1,000	Alexandria, Agnes Lake		300
Garrison, Big Blue River		400	Darling Lake		300
Geuda Springs, Jannita Lake		250	Henry Lake		250
Girard, Higgie's lake		1,000	Victoria Lake		300
Hays, Big Creek		300	Deerwood, Agat Lake		850
Hill City, Brush Creek		200	Forada, Union Lake		300
Hillsboro, Hiebert's pond		125	Lutsen, Chrissie Lake		95
Jetmor, Pawnee Creek		300	Mankato, Lake Washington		300
Kansas City, Morrison's lake		250	Mound, Langdon Lake		300
La Crosse, Fitzgerald Pond		125	Ortonville, Big Stone Lake		400
Larned, Pawnee Creek		450	Osakis, Lake Osakis		500
Leoti, Tree Pond		125	St. Paul, Minnesota Fish Commission		5,100
Lyndon, Salt Creek		500	St. Peter, Lake Jefferson		300
Manhattan, McDowell Creek		250	Swan Lake		300
Marion, Clear Creek		250	Smiley, Pelican Lake		300
Middle Creek		300	Mississippi:		
Rainbow Lake		150	Aberdeen, Jandon's pond		100
Medicine Lodge, city reservoir		100	Ackerman, Gaston's pond		150
Miltonvale, Chapman Creek		200	Woodward's pond		100
Oswego, Elm Run		150	Baldwyn, Garner's pond		150
Peabody, Catlin Creek		150	Blue Mountain, Simmons's pond		100
Country Club Lake		250	Cedar Bluff, Miller's pond		150
Davis Creek		150	Tribble's pond		150
Doyle Creek		200	Corinth, Sugar Knoll Pond		150
Henry Creek		200	Waukomis Lake		300
Rock Island Reservoir		150	Cotton Plant, Gassoway Pond		100
Spring Creek		200	Guntown, Webb's pond		150
Pittsburg, Idle Hour Park Lake		150	Lewisville, Spring Branch		100
Kuhn's pond		150	Macon, Boswell's pond		100
Scott, Timber Canyon Creek		125	Eiland Pond		250
Topeka, Samson's lake		100	Jones's pond		150
Varck, Spring River		300	Mill Pond		150
Vassar, Dragoon Creek		300	Okolona, Baker's lake		120
Weir City, Anderson's lake		200	Penn, Big Pool		150
Wichita, Little Arkansas River		300	Rienzi, Scally Pond		150
Seiller's pond		125	Scooba, Long Lake		150
Windfield, Walnut River		300	Shuqualak, Hudson's pond		200
Yates Center, Power Company's reservoir		1,500	Reed's pond		100
Maryland:			Steel's pond		250
Cockeysville, Ridgeley Creek		150	Swan Lake		102
Dorchester County, Bright's pond		200	Starkville, Daley's pond		100
Fruitland, Tony Pond		200	Lewis's pond		200
Gaithersburg, Fulk's pond		150	Russell's pond		200
Hagerstown, Beaver Creek		200	Welborn's pond		150
Big Antietam Creek		300	West Point, Tibbee Lake		250
Lansdowne, Rider's pond		100	Missouri:		
Middleburg, Big Pipe Creek		300	Blackman, Railroad pond		150
Roxbury, Antietam Creek		200	Clinton, artesian lake		250
Snow Hill, Burk's Mill Pond		200	Dodson, Rule's pond		300
Pocomoke River		200	Ferguson, Chambers Lake		100
Trappe, Beaverdam Mill Pond		200	January's pond		100
Worton, Fairlee Pond		200	Fredericktown, St. Francis River		100
Massachusetts:			Glen Echo, Lake McCreery		100
Westford, Burge's pond		100	Goodman, McAntire's lake		200
Flushing		100	Harrisonville, Woodland Lake		200
Stony Brook		100	Henley, railroad lake		350
West Gloucester, Dikes Meadow Pond	345	200	Horine, Johnson's lake No. 1		2,000
Michigan:			Windsor Lake		100
Calumet, Lake Bailey		292	Horse Shoe Lake, Horse Shoe Lake		1,500
Crystal Falls, Lake Marie		300	Joplin, Freeman's pond		200
Eckerman, Deerheart Lake		292	Marshall, Martin's lake		100
			Morrisville, Sac River		200
			Nevada, Katy Allen Reservoir		400

Details of Distribution of Fish and Eggs—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Missouri—Continued.		
Oasis Club Station, Fish Slough		1,500
Pierce City, Clear Creek		2,000
St. Louis, Bissell's pond		200
Forest Home Lake		1,000
Jaeger's lake		100
Kaiser Pond		1,000
Schilling's lake		85
Seneca, Lost Creek		200
Wappapello, St. Francis River		150
Wentzville, mill pond		1,000
Willow Springs, Alsup Pond		100
Harkey's pond		100
Indian Creek		100
Noblet Creek		100
railroad reservoir		185
Windsor, Rock Island Park Lake		175
New Hampshire:		
Claremont, Rocky Bound Pond	255	
West Springfield, Koblemark Lake	255	
New Jersey:		
Newfoundland, Ocean Park Lake		100
New Mexico:		
Logan, Aurora Pond		200
Santa Rosa, Agna Negro Lake		300
Springer, Jaritas Reservoir		500
Tucumcari, Cedar Hill Pond		225
New York:		
East Worcester, Hudson Lake		200
Liberty, White Lake		200
Monticello, Kiamesha Lake		200
Sackett Lake		200
Morrisville, Eaton Brook Reservoir		200
Pecksport, Pecksport Ponds		200
St. Joseph, Merriwold Lake		200
Tarrytown, Gracemere Lake		100
North Carolina:		
Alma, Lumber River		200
Andrews, Valley River		100
Ararat, Simpson Pond		100
Asheboro, Cox's lake		100
Humbles Pond		200
Winningham Lake		100
Asheville, Asheville School Lake	3,000	
Bahama, Mangam's pond		200
Belmont, South Fork of Catawba River		80
Benson, Ivy Pond		275
Brinkley, Steep Run		150
Candor, Clark's pond		100
Catawba, Catawba River	2,000	
Charlotte, Waterworks pond		200
Clarkton, Baldwin's mill pond		300
Clinton, Abrams Branch		140
Clyde, Smather's pond		150
Eagle Springs, Drowning Creek Pond		100
Fayetteville, Bull Spring Pond		135
Green's pond		135
Flat Rock, Smyth's pond	1,000	
North Carolina—Continued.		
Graham, Alamance Pond		300
Greenlee, Tate's pond		100
Greensboro, Park Pond		100
Terra Cotta Pond		100
Troxler's pond		150
Harrisburg, Rocky River		80
Havelock, Great Lake		250
Little Lake		300
Hickory, Jacobs Fork River		200
Jackson Springs, Currie's lake		200
Meadow Creek Mill Pond		100
Mill Creek Pond		200
Lexington, Hairston's mill pond		150
Lillington, Ballard Pond		200
Louisburg, Sandy Creek		100
Lowell, Big Long Creek		80
South Fork of Catawba River		80
Maiden, Providence Mill Pond		300
Manchester, Pasture Branch		100
Manson, Nutbush Pond		100
Marion, Buck Creek		150
Catawba River		700
Pool's pond		200
Maxton, Lumber River		400
Monroe, Houston Fish Pond	2,000	
Morganton, Johns River	1,500	
Mount Airy, Beaver Creek Pond		150
Mount Gilead, Little River		200
Murphy, Hiawassee River		100
New Hill, Rollins's pond		100
Pineville, Catawba River	2,000	
Polkton, Lanes Creek		200
Raleigh, Bain's pond		150
Buffalo Creek		100
Johnson Mill Pond		300
Lake Lucerne		300
Reidsville, Glady Creek Pond		100
Iron Works Pond		200
Roxboro, Loch Lily Pond		200
Ruffin, Stony Fork Pond		100
Williamson's pond		200
Rutherfordton, Watson Pond		100
Salisbury, Agner's pond		40
Dutch Creek Pond	2,000	
Kesler's mill pond	1,000	150
Spring Pond	1,000	
Selma, Nevassa Pond		200
Spring Hope, Farmer's pond		100
Stokesdale, Troublesome Creek		100
Tryon, Hill Top Branch		1,500
Pacolet River	3,000	
Tuscola, Branch Pond		250
Varina, Johnson's pond		200
Wade, Hatcher's pond		135
Wadesboro, Brown Creek	1,500	
Cedar Creek		150
Duck Pond	1,000	
Polk Bathing Pond		100
Walls Lake		200
Warren Plains, Hunter's pond		100
Warsaw, Williams Mill Pond		180
Wilbon, J. L. Adcock's pond		100
J. W. Adcock's pond		150
Buckhorn Creek Pond		100
Olive's pond		100
Powell's pond		100
Winston Salem, Vance's pond		100

Details of Distribution of Fish and Eggs—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.		
Winston Salem, Waterworks Pond		200
Zirconia, Green River		150
Jones Creek		1,000
North Dakota:		
Beach, Little Beaver Pond		200
Bottineau, Clara Lake		300
Lake McCarthy		150
Lake Metigoshe		1,200
Larson Lake		100
Loon Lake		350
Crary, Wood Lake		300
Devils Lake, Devils Lake		300
Fresh Water Lake		300
Dunseith, Sylvan Glen Lake		200
Fullerton, tributaries of Wild Rice River		300
Lakota, Swan Lake		300
Maza, Big Coulee Creek		150
Ellis Lake		200
Erwin Lake		150
McHenry, Wanatha Lake		300
St. John, Ash Lake		200
Carpenter Lake		200
Gravel Lake		200
Kane Lake		150
School Section Lake		150
Souris, Dalen's lake		300
Sykeston, Lake Hiawatha		300
Thorne, Mineral Lake		200
Robeth City Lake		200
Valley City, Sheyenne River		300
Ohio:		
Cambridge, Lake Guernsey		150
Canfield, Indian Creek		100
Lake Mahoning		100
Cleveland, Lake Fairbank		100
Lowers Lake		125
Coalburg, Little Yankee Run		150
Findlay, Blanchard Fork of Auglaize River		150
Fort Jennings, Auglaize River		150
Fremont, Sandusky River		125
Geauga Lake, Geauga Lake		125
Lexington, South Fork of Clear Fork Creek		150
Mansfield, Black Fork of Mohican River		150
Clear Fork Creek		150
Flemingo Creek		100
Mifflin Lakes		100
North Fork of Clear Fork Creek		150
Petersburg Lake		100
Mantua, Cuyahoga River		125
Marion, Sciota and Olentangy rivers		200
Napoleon, Maumee River		200
Newark, Buckeye Lake		200
Tiffin, Creeger Pond		150
Mohawk Lake		150
Sandusky River		450
Wapakoneta, Auglaize River		150
Watertown, Wolf Creek		150
Oklahoma:		
Ames, Hoyle Creek		125
Avard, Vesper Lake		175
Crescent, Johnson's lake		100
Knowles's pond		100
Walker's lake		150
Curtis, Crooked Lake		225
Cushing, Dunkin's reservoir		125
Doxey, Craft's lake		100
Drummond, Roberts's pond		150
Oklahoma—Continued.		
Enid, Clear Creek		250
Crane's lake		100
Enid Gun Club Pond		200
Lake Cromwell		100
Miller's pond		100
Sand Creek		125
Sawyer's pond		150
Skeleton Creek		175
Spring Creek		225
Wild Horse Creek		100
Wyssmann's pond		100
Fairmont, Horse Creek		200
Fallis, Brown's lake		150
Lake Hamer		150
Fay, Whirlwind Creek		125
Foss, Spring Creek		125
Garber, Garden Pond		100
Glencoe, Baggett's pond		100
Greenup, railroad reservoir		300
Guthrie, Cimmaron Lake		100
Duke's lake		125
Solberg's pond		150
Twin Lakes		125
Guymon, Frisco River		200
Hallett, Fox's pond		100
Jefferson, Amick's pond		100
Lucien, Bullitt Pond		150
Manchester, Fairview Pond		75
Manchester Park Lake		200
Nelson's pond		300
Maremac, Maremac Lake		200
Medford, Rowe's lake		100
Nelagony, Big Hominy Creek		150
Bird Creek		150
Clear Creek		150
Little Hominy Creek		150
Rock Creek		200
Sand Creek		150
Newkirk, Railroad Lake		200
Osage, Osage Reservoir		200
Perry, Bullitt Lake		350
Bryan's pond		100
Walker's pond		300
Wilcoxan's pond		100
Ponca City, Coon Creek		300
Pond Creek, Crystal Springs		100
Sayre, K. and T. Lake		100
Young's lake		100
Stillwater, Bullock's pond		100
Curtis's pond		100
Davis's reservoir		100
Flemming's pond		150
McFarland's pond		125
Worley's pond		100
Yost Lake		200
Waukomis, Hackberry Creek Pond		100
Pennsylvania:		
Ashland, Bolick Creek		100
Dark Corner Creek		100
Deep Creek		200
ice pond		100
Collegeville, Skippack Creek		100
Doylestown, Pine Run		39
East Earl, Conestoga Creek		250
Glen Riddle, Surray Dam Pond		78
Hanover, Big Conewago River		300
Lebanon, Conewago Creek		200
Kline's dam		230
Laudermilches Dam		200
Lights Lake		200

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.		
Lebanon, Little Swatara Creek		100
Mount Gretna Lake		200
Quittapahilla Creek		200
Raccoon Creek		150
Reeds Creek		150
Straek Lake		200
Stovers Lake		200
Swatara Creek		200
Waterhouse Dam		200
Lenhartsville, Marden Creek		100
Lewisburg, Buffalo Creek		350
McKnightstown, Small March Creek		150
Mechanicsburg, Conodoguinet Creek		300
Mendenhall, Longwood Lake		39
Mercersburg, West Branch of Conococheague Creek		250
Mount Alto, Big Pond		100
Newtown, Neshaminy Creek		40
Oaks, Skippack Creek		100
Pinegrove, Merrill Creek		100
Reading, Tulpehocken Creek		250
Susquehanna, Susquehanna River		200
York, Bermudian Creek		200
Dierdorffs Dam		250
Myers Dam		250
Rhode Island:		
Kingston, Silver Lake		200
South Carolina:		
Allendale, Bostick's pond		200
Connor's pond		2,000
Anderson, mill pond		100
Thompsons Creek Pond		100
Wilsons Creek Pond		100
Belton, Belton Mills Pond		2,000
Bethune, Motley Branch Pond		300
Blacksburg, Broad River		5,800
Chappells, Stroth's pond		1,000
Webb's pond		1,000
Cherokee County, Kings Creek		1,000
Cherokee Falls, Broad River		1,000
Clifton, Pacolet River		500
Clover, Catawba Power Company Pond		100
Crowders Mill Creek Pond		500
Columbia, Congaree River		1,000
Hampton Creek		2,000
Horse Shoe Lake		221
Musser's mill pond		3,000
Shand Mill Pond		1,000
Converse, Pacolet River		1,000
Cowpens, Island Creek Pond		500
Martin's mill pond		500
Thickety Creek		1,000
Webster's pond		365
Creston, Edward's pond		1,500
Denmark, Mitchell Pond		1,000
Duncans, Moore's pond		125
Edmund Ginard's pond		150
Enoree, Beaverdam Creek		1,000
Fort Lawn, Daniel's pond		1,000
Fountain Inn, Rocky Creek Pond		1,000
Gaffney, Broad River Pond		500
South Carolina—Continued.		
Gaffney, Limestone Creek Pond		150
People's creek		1,000
Gilbert, Black Fowls Pond		500
Taylor's lake		1,000
Glenn Springs, Berry Weathers's pond		750
Borroughs Lake		1,000
Cathcart pond		750
Fair Forest Lake		2,000
Glenn Springs Branch Pond		450
Mineral Branch Pond		3,000
Graniteville, Curry's pond		1,000
Graniteville Pond		750
Greers, South Tyger River		1,000
Greenville, Buckhorn Creek		1,000
Cox Lagoon		1,500
Cureton's pond		200
Earle's pond		200
Mountain Creek		500
North Saluda River		500
Power Company's lake		4,000
Saluda River		2,000
Tanglewood Pond		1,000
Woods Pond		1,000
Woodside Cotton Mills reservoir		200
Greenwood, Cole's Mill Pond		2,000
mill pond		1,000
Honea Path, Clear Pond		1,000
Inman, Clark's pond		150
Lawsons Fork Creek		200
Meadow Creek		1,150
Kershaw, Gregory's pond		500
Haile Gold Mine Pond		500
Kirkley's Mill Pond		750
Kinards, Bush River		500
Laurens, Duncans Creek		1,000
Leesville, Able's pond		300
Bodie's springs		150
Clark Pond		125
Lexington, Spring Branch Pond		1,000
Montmorenci, Pigeon Branch		1,000
Neeses, Boltin Pond		1,000
Newberry, Wilburs Pond		100
North Augusta, Harley's pond		225
Orangeburg, Crystal Springs		156
Pelion, Barr's pond		100
Round Pond		500
Perry, Indian Head Pond		100
Piedmont, Brushy Creek		2,000
Grove Creek		2,000
Saluda River		2,000
Richburg, Hicklin's pond		300
Rock Hill, Catawba Power Company's mill pond		1,950
Dutchman Creek		650
Sally, Whites Pond		150
Simpsonville, Cox's pond		1,000

Details of Distribution of Fish and Eggs—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings and adults.
South Carolina—Continued.		
Spartanburg, Arcadia Mill pond		3,000
Dean's pond		125
Fairforest mill pond		1,500
Lawson Fork Creek		600
Pacolet River		975
Paris Pond		150
Sholey Creek		250
Whitney Pond		150
Starr, Spring Creek		350
Sumter, Osteen Mill Pond		100
Switzer, fish pond		150
Taylors, Raines's pond		1,000
Tirzah, Flexico Mill Pond		100
Trenton, Bayhams Pond		1,000
Colemans Pond		1,000
Long Pond		1,000
Lorick's Mill Pond		150
Miller's pond		1,000
Quarles's pond		1,000
Union, Dawkins Pond		2,200
Wellford, Berry's pond		1,000
Jordon Pond		1,750
Middle Tyger Creek		2,000
North Tyger Creek		2,000
Tucapau Mill Pond		250
Westville, Cauthan's pond		500
Woodford, Galen Branch		1,000
Woodruff, Enoree River		200
Yorkville, Crowders Creek		500
Jackson's pond		600
Moore's lake		500
South Dakota:		
Big Stone, Big Stone Lake		500
Tennessee:		
Cleveland, Spring Lake	1,000	
Wildwood Lake	1,000	
Heiskell, Almar Lake	1,000	
Luttrell, Hamilton's lake	1,000	
Marlowe, Blue Spring Pond	1,000	
Morrison, Bakers Spring Lake	1,000	
Newport, Big Pigeon River	2,500	
Oliver Springs, Windrock Mountain Lake	1,000	
Ravenscroft, Lake Eola	1,500	
Rockford, Little River	1,500	
Sparta, Rhea's pond	1,000	
Tazewell, Baldwin's pond	1,000	
Mayes's Mill Dam	1,000	
Texas:		
Abbott, Harwell's Lake		21
Amarillo, Horstburgs Creek		666
Arlington, Monzingo Pond		100
Austin, Radams Garden Lake		200
Avery, O'Bannon's pond		100
Baird, Hubbard Pond		100
Bastrop, Mining Company's pond		21
Young's pond		21
Bennetts, Perkins Pond		150
Big Sandy, Big Sandy Lake		1,000
Black Lake		300
Boating and Fishing Club Lake		500
Bruce's lake		300
Furgeson's pond		500
Lake Everman		1,000
Lake Key		500
Lake Lorene		500
Lake Thorne		500
Todd Lake		500
Texas—Continued.		
Blossom, Deerpark Pond		150
Jones's lake		150
Brady, Shinook Lake		100
Brownwood, Adams's lake		300
Brownwood Lake		100
Camp s pond		300
Cat Mountain Pond		100
Clardy Lake		200
Conway's lake		150
Cordell's lake		400
Davitte's lake		100
Hargrave's lake		300
Hurlbut's lake		200
Mauldin's lake		300
Morse Lake		300
Natural Lake		300
South Brownwood Lake		100
Tannehill Lake		100
Cameron, Hefley Pond		100
Schiller's pond		100
Canadian, Stag Lake		334
Channing, Crawford's Pond		16
Cheatham, Plummer's pond		150
Chilton, Cow Bayou		300
Clevenger, Gum Pond		300
Coleman, Lake Coleman		400
College Station, Royall's pond		200
Comanche, Nigs Branch		300
Comfort, Cypress Creek		500
Commerce, Jernigan's pond		20
Oil Mill Pond		20
Coolidge, Flewellen's pond		100
Gin Pond		50
Jenson's lake		100
Lewis's pond		100
Cooper, Lone Pine Lake		25
Crockett, Fish Club Lake		500
El Caney Lake		100
Lipscomb's pond		100
Milligan's pond		100
Dallas, Rod and Gun Club Lake		400
Decatur, Boyd Pond		300
Del Rio, Blaine Lake		500
Fish Lake		500
Mud Creek		1,000
San Felipe Creek		1,500
Scienagas Creek		500
Denison, Blackford's pond		75
Lake Shawnee		500
Reason Pond		75
Rod and Gun Club Lake		200
Denton, Denton Country Club Lake		300
Diboll, Diboll Pond		400
Dilworth, Mooney Lake		500
Elmina, Foster's pond		700
El Paso, Smith's lake		50
Falfurrias, reservoir		100
Floresville, Dewees's pond		50
Forney, Lake Weldon		70
Fort Worth, Murphey's pond		20
Tony Lake		600
Frisco, Lake Bonnie		500
Roger's pond		120
Galveston, Cade's pond		300
Ganahl, Elan Creek		500
Garland, Lyles's lake		20
Giddings, Nankin's pond		150
Warlich's pond		200

Details of Distribution of Fish and Eggs—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Texas—Continued.		
Glidden, Glidden Reservoir		100
Graham, Dolton's pond		20
Norris's lake		500
Turtle Pond		20
Granbury, Blue Branch Lake		300
Cogdell's lake		100
Stewart's lake		100
Grand Saline, Deepwater Pond		150
James's pond		150
Lake of the Woods		200
Grand View, artificial lake		20
Greenbrier, Greenbrier Lake		50
Groesbeck, Davis's lake		100
Gunter, Sherman County Club Pond		600
Hallettsville, Huser's pond		150
Henderson, Graham Lake		28
Hereford, Bowers's lake		120
Hillsboro, Katy Lake		21
Lake Park Lake		84
Holland, Flag Branch		21
Honey Grove, Country Club Lake		300
City Lake		300
Henderson's lake		300
Holt's lake		200
Horse Shoe Lake		300
Iatan, Foster's lake		16
Irene, Greer's lake		150
Myrick Lake		700
Zollicoffer's lake		150
Irving, Haley's pond		100
Jacksboro, Carrolls Creek		200
Knox's lake		200
Los Creek		200
Jasper, Seale's Mill Pond		500
Kaufman, Farm Pond		425
Griggsby's pond		150
Kemp, Hog Ranch Pond		203
Kenedy, Bain's pond		150
Kennedale, Village Creek		500
Kingsland, Ligon's mill pond		150
Kingsville, Alexander's reservoir		150
Larson's reservoir		150
McNeel's lake		150
Pattison's reservoir		150
Simonson's reservoir		150
Warren Reservoir		150
Young's reservoir		150
Lacoste, Fresh Water Lake		150
Lagrange, Melcher's pond		200
Lampasas, Donaldson Creek		400
Green Frog Lake		150
Lucy Creek		300
Mesquite Creek		300
Pitt Creek		300
School Creek		300
Simms Creek		300
Llano, Llano Lake		500
Llano River		1,000
Longview, Lake Edna		100
Marshall's pond		100
Lott, City Lake		300
Looka's pond		300
Lovelady, Phipps's pond		100
Mabank, Aston's pond		125
Robertson's lake		200
Wisdom's lake		150
Texas—Continued.		
Mabank, Wren's pond		150
Mart, Fishing Club Lake		500
Memphis, Bryant's lake		150
Mexia, artificial lake		300
Mineola, Glade Creek Pond		200
Mineral Wells, Howard's pond		200
Mount Pleasant, water works reservoir		500
Nacogdoches, Lindsay's pond		300
Nara Visa, Bold Spring		200
Palestine, Spring Park Lake		200
Panhandle, Bear Creek Springs		500
Bugbee Creek		500
Moores Creek		500
Paris, Bankhead's lake		400
Boyd's lake		300
Henley's lake		200
Lightfoot's pond		200
Pine Creek		400
Williams Park Pond		150
Pasadena, Little Vince Bayou		50
Perry, Oaks's pond		75
Red Gin Pond		200
Petty, Faritt's pond		150
Plano, Kendrick's pond		300
Quanah, Lake Damsite		1,000
Ravenna, Little's pond		150
Rockdale, Randle Lake		200
Rosebud, Bradley's pond		200
Waters's pond		300
Sabinal, Davenport's pond		200
San Angelo, Dove Creek		500
Middle Concho Creek		500
Spring Creek		500
Sanger, Pond Creek		400
Schulenburg, Clark's pond		300
Seguin, Guadalupe River		500
Sherman, Fallon's pond		30
Gunter Switch Lake		500
Lyon's lakes		300
Seven Mile Pond		400
Skidmore, Aransas River		500
Smithville, Big Tank Lake		300
Jones's lake		150
Stanley, Livingston Lumber Company's pond		200
Stephenville, Bridges Pond		100
Faulkner's pond		150
Stowell, McManus Pond		400
Stratford, Williams's lake		150
Strawn, Barrett's pond		300
Edgewood Pond		200
Sweet Water, Deering's pond		500
Taylor, Burne's lake		400
Temple, city reservoir		300
Lake Polk		200
Terrell, Asylum Lake		300
Bachelor Pond		300
Berry Lake		300
Freeman's pond		150
Griffith's pond		500
Grinnan's pond		450
Landry's lake		300
McCortney Pond		150
Porter's pond		300
Spring Pond		300
Tickell's pond		300
Weatherford Pond		300
Yates Pond		300
Thorndale, Moerbe Lake		200
Timpson, Smith Lake		300
Trinity, artificial lake		200

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Texas—Continued.		
Trinity, Skains Lake		100
Uvalde, Lena River		1,000
Nueces River		1,000
Vernon, Castleberry's lake		250
Lake Kell		200
Waco, artesian lake		150
Durham's lake		250
Lake Ross		200
Waller, Mound Creek		500
Waxahachie, Patrick's pond		100
Weatherford, Everett's pond		100
Redoak Lake		150
Wellborn, Lake Douglas		125
Whitewright, Sears's pond		40
Wills Point, artificial lake		150
Clear Lake		200
Huckeley's lake		200
Manning's pond		200
Valley View Lake		300
Williams's pond		400
Wylie, mill pond		150
Yoakum, Hall's pond		500
Pulliam Pond		300
Virginia:		
Alpha, Hatcher Creek		150
Beaverdam, Thompson's pond		400
Bon Air, Roslyn Pond		19
Boyce, Shenandoah River		100
Bristol, Bristol Reservoir		1,000
Charlotte Court House, Carewile's pond		150
Charlotte Court House, Robertson's pond		100
Charlotte Court House, Williams's pond		100
Chatham, Martin's pond		100
Cohoke, Cohoke Pond		400
Danville, Dan River		250
Shady Pond		100
Dinwiddie, Cat Tail Branch		159
Drakes Branch, Eggleston's pond		100
Edinburg, Stony Creek		150
Ford, Butterwood Creek		158
Freeman, Jolly's pond		50
Green Bay, Wing's pond		100
Greensprings, Valentine Mill Pond		400
Harrisonburg, Branch of North River		150
Harrisonburg, Silver Lake		250
War Branch		150
Howardsville, Algoma Pond		200
Isle of Wight, Porter's pond		100
Lee, Jones Creek		200
Lester Manor, Walkerton Mill Pond		150
Lexington, North River		175
Lynchburg, Hughes's Mill Pond		100
Mount Jackson, North Fork of Shenandoah River		200
Mount Jackson, Orkney Lake		75
Newmarket, North Fork of Shenandoah River		150
Newmarket, Smith Creek		150
Paynes, Hardware River		200

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Virginia—Continued.		
Raynor, Vellines's pond		100
Sassafras, Stubbs's Mill Pond		100
Summerset, Rapidan River		200
Strasburg Junction, Shenandoah River		300
Sweetbrier, Sweetbrier Lake		200
Tettington, Sandy Point ice pond		150
Timberville, Loch Willow Pond		50
Toano, Aspen Grove Pond		100
Whitehouse, Richmond Shooting Club Pond		200
Winchester, Back Creek		200
Hogue Creek		200
Woodstock, North Branch of Shenandoah River		150
West Virginia:		
Fort Spring, Greenbrier River		155
Fort Spring, Second Creek	5,000	
Holly Junction, Elk River		400
Parkersburg, Jackson's pond		200
Little Kanawha River		565
Patterson Creek, Patterson Creek		300
Wisconsin:		
Amherst Junction, Lake Emily		500
Campbellsport, Forest Lake		300
Centuria, Balsam Lake		300
Cumberland, Beaverdam and Sand lakes		400
Elcho, Enterprise Lake		500
Glenbeulah, Crystal Lake		500
Gordon, Bass Lake		300
Blue Gill Lake		300
Clear Lake		300
Leader Lake		300
Wagner Lake		300
Grand Rapids, Consolidated Pond		700
Grantsburg, Deep Lake		300
Hayward, Lake Court O'Reilles		300
Independence, Independence Mill Pond		500
Iron County, Pine Lake		300
La Crosse, Mississippi River		5,000
Lake Nebagamon, Lake Nebagamon		300
Minocqua, Trout Lake		8,500
Neshkora, Neshkora mill pond		500
Prentice, Worcester Lake		295
Rhinelander, Ebey Lake		300
Lirenen Lake		300
Pine Lake		300
Spider Lake		300
Richfield, Bark Lake		300
Emma Belle Lake		300
Sobieski, Bass Lake		600
Sparta, Bushnell's pond		600
Perch Lake		600
Sturgeon Bay, Sturgeon Bay		4,000
Superior, Bass Lake		300
Total[a]	42,355	463,935

[a] 3,500 fry and 15,470 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

BREAM, OR SUNFISH.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Alabama:		
Andalusia, Radford's pond		200
Anniston, Cain Creek		100
Attalla, Big Wills Creek		300
Chambers County, McCosh's Pond		100
Daleville, Mansfield's Mill Pond		200
Dickinson, Pugh Springs		50
Elba, Beaverdam Creek		100
Donaldson's lake		100
Lee's lake		100
Eoline, Hubbard's pond		100
Medders's pond		100
Estelle, Dale's pond		50
Eufaula, Foy's pond		100
Fort Payne, Tower's lake		100
Geneva, Choctawhatchee River		125
Schoolhouse Branch		100
Greensboro, Monts' pond		100
Headland, Joiner Branch		100
Huntsville, Merrimack Lake		100
Lowndesboro, Dickson's pond		100
Midway, Bradley's pond		100
Mobile, Oil Mill Pond		100
Opelika, Jenkin's pond		100
Johnson's pond		200
Orrville, Ellis's pond		50
Ozark, Wallace's pond		100
Pine Apple, Jones's pond		50
Spring Pond		50
Pine Hill, Beaver Pond		50
Riverview Pond		50
Roanoke, Mann's pond		100
Siloam Pond		300
Round Mountain, Willow Creek		300
Taff, McBride's pond		100
Thomaston, Hollis's pond		50
Lake Charles		50
Troy, Persimmon Creek		100
Sasser Lake		100
Tuskegee, Barrows's pond		100
Union Springs, Worthington Pond		100
Arkansas:		
Eldorado, Miles's pond		100
Magnolia, Wyrick's pond		200
Stamps, Taton Creek		200
Georgia:		
Amsterdam, Bryan Lake		100
Chandi Lake		200
Mary Lake		100
Atlanta, Conoley's pond		100
Roswell Lake		100
Tyrol Lake		50
Barnesville, Marshburn's lake		1,000
Murphey's pond		100
Stallings' pond		100
Bartow, Williamsons Swamp Creek		100
Blue Ridge, Chastian Pond		125
Box Springs, Lake Mohignac		150
Cairo, Sasser Branch Pond		100
Cedartown, Big Cedar Creek		200
Liddell's pond		100
Lime Branch		200
Locke's lake		100
mill pond		200
Pumpkin Vine Creek		200
Columbus, Cleveland's pond		50
Culverton, Little Ogeechee Pond		100
Cuthbert, Dent's pond		200
Decatur, Orphanage ponds		200
Georgia—Continued.		
Eatonton, Bonner's pond		100
Jenkins's pond		100
Jones's pond		100
Spring Branch Pond		100
Ellijay, Smith's pond		125
Empire, Carnes's pond		100
Forsythe, Oakland Pond		200
Grantville, Hosiery Mill pond		100
Greensboro, Richland and Town Creek		200
Harlem, Harris's pond		100
Harrisburg, Scales's pond		100
Hazlehurst, Cook's pond		100
Hillsboro, Cedar Creek		200
Jolly, Spring Lake		50
Lithia Springs, Lithia Springs Lake		150
Marietta, Freyer's pond		150
Soaps Creek		75
Milledgeville, Colony Pond		200
Sanitarium reservoir		200
Norwood, Jones's pond		100
Rome, Fouche Mill Pond		300
Ruby, Zion Hill Pond		100
Sandersville, Rawlings's pond		100
Senoia, Coats's pond		100
Stinson, Lake Benson		200
Thomson, Granade's pond		100
Vienna, Hurd's pond		100
Woodville, Boswell's pond		100
Illinois:		
St. Clair County, Weber's lake		500
Indiana:		
Evansville, Cooks Park lake		100
Kimmell, Norris's lake		150
Winona Lake, Winona Lake		300
Indian Territory:		
Ardmore, Brown's pond		75
Compress Company's pond		50
Hickory Creek		100
Oaklawn Lake		65
Walnut Bayou		100
Tishomingo, Big Blue River		225
Kentucky:		
Crider, Harper's pond		150
Fredonia, Garah pond		300
Horse Cave, Bryant's pond		150
Newberry's pond		200
Marion, Maple Lake		100
Maryland:		
Baltimore, Maryland Fish Commission	4,200	
Mississippi:		
Baldwyn, Davis's pond		50
Garner's pond		50
Boonville, Boonville Lake	1,000	
Egypt, Smith's pond		200
Saltillo, Dillard's lake	300	
Shannon, Long's pond		330
Missouri:		
Ashgrove, Blue pond		200
Creve Coeur, Creve Coeur Lake		300
Mansfield, Matlock Creek		200
Neosho, Hickory Creek		450
Seneca, Finch's pond		200
New Mexico:		
Portales, Pendegraft's pond		50
Roswell, Berrenda Lake		65
Leland Pond		50
New York:		
East Worcester, Hudson Lake		250

Details of Distribution of Fish and Eggs—Continued.

BREAM, OR SUNFISH—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
North Carolina:		
Belew Creek, Linville Fish Pond		200
Brevard, Elks Lake		300
Lambs Creek Lake		800
Patton's pond		200
Yongue's lake		400
Fremont, Acock's pond		400
Glen Alpine, Silver Creek Branch		100
Hendersonville, Mill Creek		500
Tom's pond		500
Morven, Pratt's pond		500
Pittsboro, Elm Pond		200
Wheeler's pond		200
Raleigh, Buffalo Creek		300
Patton's pond		500
Crocker's pond		300
Lake Lee		700
McGee's pond		200
Riverside Club Pond		1,000
Rogers's pond		200
State Prison Lake		300
Spring Hope Brookside Lake		300
Rice's pond		200
Spring Branch Pond		300
Winston Salem, Vance's pond		200
Ohio:		
Holmesville, McCune's pond		100
Mansfield, Peters's pond		100
Oklahoma:		
Cache, Cache Creek		1,200
Enid, Leight's pond		230
Indiahoma, Wagner Pond		75
Pennsylvania:		
Landrus, Flat Town Pond	400	
South Carolina:		
Abbeville, Calhoun Creek Pond		100
Aiken, Johnson's pond		50
Allendale, Connor's pond		100
Calhoun, Seneca River		100
Charleston, Goose Creek Lake		1,000
Magnolia Lakes		100
Columbia, Bouknight Pond		100
Calico Branch		100
Hampton Creek		800
Messer's mill pond		100
Edgefield, Anderson's pond		125
Dunovant's pond		125
Hollingsworth's pond		1,000
Edmunds, Gingnard's pond		500
Gaffney, Little Thickety Creek		100
Greer, Maple Creek Pond		300
Honea Path, Clamp's pond		500
Cowan's pond		300
Johnston, Younce's pond		150
Kinnards, Bush River		100
Laurens, Franks's pond		200
Marion, Wilcox's pond		300
Montrose, Graham Pond		200
Newberry, Langford's pond		200
Olar, Hutto's pond		500
Owings, Beaverdam Creek Pond		200
Pickens, mill reservoir		100
Snelling, Cook's pond		150
Spartanburg, Oaks Lake		200
Starr, Pruitt's pond		200
Simpson's pond		200
Trenton, Frant's pond		500
Union, McNally's pond		300
Vance, Norris's pond		425
Waterloo, Freestone Pond		200
Westville, Cauthen's pond		600
South Carolina—Continued.		
Woodruff, Enoree River		1,200
Yorkville, Moore's lake		50
Tennessee:		
Clarksville, Ferguson's pond		80
Jackson, Crystal Lake		80
Lake Alexander		80
Johnson City, Administration Lake		55
Morristown, Hamilton's pond		200
Nashville, Pioneer Swimming Pool		80
Paris, M and B Pond		80
Tazewell, Lon's dam		100
Texas:		
Athens, Nixon Spring Branch		20
Austin, Riverview Pond		10
Big Springs, Mouldin Pond		10
Burton, Boesling's pond		30
Caldwell, Jones's pond		30
Calvert, Foster's lake		30
Knapps's lake		200
Merens's pond		50
Valley View Lake		50
Campbell, Winstead's pond		20
Corsicana, Liberty Hall Lake		50
Crockett, Davis's lake		40
Devine, Brisco's pond		20
Engle, Kalich's pond		50
Graham, Mayes's pond		40
Grand Prairie, Martin's pond		10
Greenbrier, Beckham Lake		350
Greenbrier Lake		600
Hasse, Martin's Lake		20
Henderson, Brown Lake		300
Brumley Creek		200
Mill Creek		150
Moss Lake		50
Roach's pond		40
Kaufman, Farm Pond		30
Gibbs's lake		30
Haynes's pond		30
Miles's pond		60
Lockhart, Witter's pond		20
Marshall, Adams's lake		100
Lake Fern		200
Mineola, Clanton's pond		20
Terrell, Martin's pond		200
Warren and Luke Lake		300
Washington Pond		10
Tyler, Head's lake		50
Rowland's pond		75
Weatherford, Grant's lake		40
Virginia:		
Atlee, Laurel Grove Pond		200
Bel Air, Meadowbrook Pond		600
Boydton, Goode's pond		500
Fordwick, Harper's pond		200
Honaker, Lake James		125
Lawyers, Brandt's pond		100
Mineral, Sears's pond		200
Norfolk, Lake Joyce		500
Oakridge, Johnson's pond		100
Petersburg, hospital reservoir		200
Ringgold, ice pond		400
Wytheville, Reed Creek		90
Tates Run		4,125
Wisconsin:		
La Crosse, Mississippi River		5,000
Total[a]	5,900	56,070

[a] 13,835 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

PIKE PERCH.

State, locality, and disposition.	Eggs.	Fry.
Connecticut:		
Canaan, Half River		500,000
Lake Hokokommock		500,000
Whittlesey River		500,000
Housatonic River		500,000
District of Columbia:		
Bathing Beach, Potomac River		325,000
Illinois:		
Aurora, Fox River		500,000
Collinsville, Brickyard Lake		200,000
Copperas Creek, Illinois River		750,000
Dallas City, Mississippi River		500,000
Danville, Vermilion River		300,000
Decatur, Decatur Fish Club lake		500,000
Fox Lake, Fox River		750,000
Freeport, Pecatonica River		500,000
Greenville, Lindley's Lake		250,000
Highland, Koche's lake		250,000
Ingleside, Wooster Lake		750,000
La Grange Locks, Illinois River		1,250,000
Litchfield, Chautauqua Lake		200,000
Meredosia, Illinois River		3,000,000
Momence, Kankakee River		300,000
Naples, Illinois River		1,550,000
Quincy, Mississippi River		200,000
Indiana:		
Bass Lake, Bass Lake		500,000
Culver, Lake Maxinkuckee		1,000,000
Elkhart, St. Joseph River		500,000
Macy, South Mud Lake		500,000
New Carlisle, Hudson Lake		500,000
Sauganey Lake		500,000
Warsaw, Winona Lake		500,000
Kansas:		
Garnett, Hazledell Lake		300,000
Marion, Cottonwood River		300,000
Kentucky:		
Greensburg, Green River		1,000,000
Massachusetts:		
Athol, Long Pond		500,000
Falmouth, Mares Pond		500,000
Wilkinsonville, Massachusetts Fish Commission	3,000,000	
Michigan:		
Alpena, Lake Huron		1,500,000
Bancroft, Agnew Lake		500,000
Bay City, Saginaw Bay		2,000,000
Detroit, Detroit River		10,000,000
Michigan Fish Commission	50,000,000	
Lincoln, West Twin Lakes		500,000
Manitou Beach, Devils Lake		500,000
Marine City, St. Clair River		2,500,000
New Richmond, Kalamazoo Lake and River		500,000
St. James, Forest Lake		500,000
Minnesota:		
Cromwell, Island Lake		300,000
Smiley, Lake Cullom		200,000
Pelican Lake		300,000
Missouri:		
Moons Mill, St. Francis River		700,000
St. Joseph, Missouri Fish Commission	10,000,000	
New Hampshire:		
Keene, Spofford Lake		500,000
New Jersey:		
Princeton, Carnegie Lake		500,000
New York:		
Apulia, Carpenter's pond		500,000
Bloomingburg, Shawaugunk Kill		800,000
Cambridge, Schoolhouse Pond		480,000
Cape Vincent, St. Lawrence River		4,500,000
Hemlock, Woodruff's Mill Pond		500,000
Kingston, Yankeetown Pond		500,000
Middletown, Walkill River		800,000
Richfield Springs, Youngs and Weavers lakes		500,000
Saint Josephs, Black Brook		300,000
Shushan, Dead Pond		120,000
Ohio:		
Catawba Island, Lake Erie		20,000,000
Isle St. George, Lake Erie		40,000,000
Kelleys Island, Lake Erie		48,000,000
Lakeside, Lake Erie		20,000,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

PIKE PERCH—Continued.

State, locality, and disposition.	Eggs.	Fry.
Ohio—Continued.		
Leavitsburg, Mahoning River		1,000,000
Middle Bass Island, Lake Erie		20,000,000
Port Clinton, Lake Erie		40,000,000
Put-in-Bay, Lake Erie		40,000,000
Pennsylvania:		
Allenwood, West Branch of Susquehanna River		1,000,000
Athens, Chemung River		500,000
Beavertown, Middle Creek		500,000
Erie, Pennsylvania Fish Commission	194,150,000	
Great Bend, Susquehanna River		800,000
Hopewell, Raystown Branch of Juniata River		760,000
Yellow Creek		475,000
Milan, Susquehanna River		1,000,000
Plymouth Meeting, Plymouth Creek		500,000
Rising Springs, Penns Creek and tributaries		800,000
Stewarton, Youghiogheny River		900,000
Williamsport, Loyalsock Creek		800,000
York Haven, Susquehanna River		588,000
Vermont:		
East Fletcher, Metcalf's pond		500,000
Franklin, Franklin Pond		500,000
Johnson, Lake Eden		600,000
North Hero Isle, Lake Champlain		3,875,000
Ricker Mills, Groton Lower Pond		1,000,000
Sheldon, Black Creek		500,000
Swanton, Gander Bay		1,500,000
Goose Bay		1,500,000
Lake Champlain		60,525,000
Missisquoi River		3,000,000
tributaries of Lake Champlain		5,000,000
Vergennes, Otter Creek		1,500,000
Wilmington, Ray Pond		500,000
Virginia:		
Courtland, Nottoway River		375,000
Wisconsin:		
Marillan, Oakwood Lake		500,000
Sussex, Lake Keesus		500,000
Withee, Hopper River		600,000
Total[a]	257,150,000	370,773,000

[a] 577,000 fry were lost in transit.

YELLOW PERCH.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Connecticut:			
Canaan, Chapinville Pond		500,000	
Lake Pennehecconnock		500,000	
Lake Washining		500,000	
Long Pond		500,000	
Plantain Lake		500,000	
Round Pond		500,000	
Turtle Pond		500,000	
Windsor locks, Connecticut Fish Commission		500,000	
District of Columbia:			
Monument Lot, fish ponds		100,000	
Illinois:			
Antioch, Petite Lake			125
Ashland, Stribling's pond			100
Barrington, Rundell Lake			300
Bishops Hill, Lock's pond			150
Bloomington, Millers' lake			600
Chrisman, Sommerville's lake			300
Clayton, Parr's pond			150
Zeiger's pond			150
Crystal Lake, Crystal Lake			400
Decatur, Moffitt's lake			450
Starr's lake			600
Deer Creek, Zehr's pond			200
Earlville, Conklin's pond			100
Elburn, Gray's pond			100
Freeport, Pecatonica River			200
Galesburg, Panky's pond			100

DETAILS OF DISTRIBUTION OF FISH AND EGGS—Continued.

YELLOW PERCH—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Illinois—Continued.			
Genesee, Green River			400
Golden, Emming's pond			300
Joliet, Hobb's pond			200
Kewanee, Glen Oak Lake			100
Lake Villa, Cedar and Beet lakes			100
Sand Lake			300
Lamont, Quarry Pond			100
Lincoln, Salt, Sugar, and Kickapoo creeks			600
Marengo, Metcalf's pond			500
Markham, Rankin's pond			300
Naperville, Quarry Pond			550
Ottawa, Fox River			200
Plainfield, Du Page River			500
McKenna's pond			100
Pekin, City Park Pond			300
Riverside, Walker's pond			550
Sherman, Orchard Farm Pond			300
Waterloo, Beaver Lake			150
Bissell Lake			150
Island Lake			150
Lake Bartlett			150
Woodhull, Lowry's pond			100
Kansas:			
Garnett, South Fork Creek			20
Maryland:			
Accokeek Creek, off mouth, in Potomac River		18,328,600	
Baltimore, Maryland Fish Commission	10,400,000		
Battery Haul, Chesapeake Bay		8,300,000	
Broad Run, off mouth, in Potomac River		4,485,000	
Cecil County, Furnace Creek		15,000,000	
Charlestown, Northeast River		20,000,000	
Harford County, Spesutie Narrows		5,000,000	
Swan Creek		52,200,000	
Piscataway Creek, off mouth, in Potomac River		12,610,000	
Town Point, Elk River		49,455,000	
Massachusetts:			
Foxboro, Sunset Lake		500,000	
Minnesota:			
St. Paul, Minnesota Fish Commission			500
New Mexico:			
Santa Rosa, Baca Lake			300
New York:			
Millerton, Grassy Lake			400
Ohio:			
Fort Jennings, Jennings Creek			100
Pennsylvania:			
Glen Eyre, Giles Glacial Pond			300
Lake Laura			300
Vermont:			
St. Johnsbury, Passumpsic River		550,000	
Sleepers River		50,000	
Swanton, Lake Champlain		4,700,000	
Virginia:			
Dogue Creek, off mouth, in Potomac River		17,742,500	
Elkton, Shenandoah River		800,000	
Little Hunting Creek, off mouth, in Potomac River		33,602,600	
Mount Jackson, North Branch Shenandoah River		835,000	
Pohick Creek, off mouth, in Potomac River		8,970,000	
Wytheville, Reed Creek			500
Wisconsin:			
Glenbeulah, Crystal Lake			120
La Crosse, Mississippi River			2,000
Total [a]	10,400,000	257,228,700	14,665

[a] 630 fingerlings were lost in transit.

Detail of Distribution of Fish and Eggs—Continued.

STRIPED BASS.

State, locality, and disposition.	Eggs.	Fry.
California:		
Bouldin Island, San Joaquin River	2,000,000	3,057,500
North Carolina:		
Roanoke Rapids, Roanoke River		70,000
Weldon, Roanoke River		3,610,000
Total	2,000,000	6,737,500

WHITE PERCH.

State, locality, and disposition.	Fry.
Connecticut:	
Seymour, Hoadleys Pond	600,000
West Redding, Spring Pond	400,000
District of Columbia:	
Washington, Potomac River	2,314,000
Maine:	
North Berwick, Banneg-Beg Pond	400,000
Maryland:	
Baltimore, Maryland Fish Commission	10,000,000
Battery Haul, Chesapeake Bay	15,770,000
Cecil County, Chesapeake Bay	32,610,000
Furnace Creek	10,000,000
Eastern Flats, Chesapeake Bay	33,175,000
Harford County, Locust Point Channel	4,451,000
Spesutie Narrows	38,000,000
Swan Creek	20,325,000

State, locality, and disposition.	Fry.
Maryland—Continued.	
Lapidum, Susquehanna River	1,449,000
Queenstown, Chester River	2,000,000
Crown Point, Elk River	46,475,000
Western Flats, Chesapeake Bay	26,600,000
Massachusetts:	
Baldwinville, Venison Lake	400,000
Moxford Station, Stiles Lake	600,000
Harvard, Nashua River	600,000
Highlandville, Rosemary Lake	400,000
Roslindale, Turtle Pond	400,000
New Hampshire:	
Hillsboro, Millen Lake	400,000
Newport, Rands Lake	400,000
West Thornton, Menor Lake	400,000
New York:	
Briarcliff, Kinderogan Pond	400,000
Sullivan County, Mountain Lake	600,000
Total	249,169,000

COD.

Maine:	
Boothbay Harbor, Boothbay Harbor	6,814,000
Bristol, Johns Bay	1,182,000
Five Islands, Sheepscott River	2,198,000
Orrs Island, Casco Bay	2,383,000
Pemaquid, Johns Bay	2,757,000
South Portland, Atlantic Ocean	3,368,000
Southport, Boothbay Harbor	750,000
Ebencook Harbor	7,644,000
Sheepscott River	1,079,000
Massachusetts:	
Beverly, Atlantic Ocean	4,224,000
Buzzards Bay, Buzzards Bay	3,474,000
Gloucester, Atlantic Ocean	41,770,000
Gosnold, Vineyard Sound	583,000
Jobs Neck, Vineyard Sound	14,169,000
Manchester, Atlantic Ocean	13,792,000

Massachusetts—Continued.	
Marblehead, Atlantic Ocean	4,724,000
Nashewena Island, Vineyard Sound	6,266,000
Nobska Light, Vineyard Sound	2,550,000
Robinsons Hole, Buzzards Bay	3,013,000
Vineyard Sound	14,566,000
Tarpaulin Cove Light, Vineyard Sound	51,897,000
Weepecket Island, Buzzards Bay	2,653,000
Quicks Hole, Vineyard Sound	6,506,000
Rockport, Atlantic Ocean	23,573,000
Ipswich Bay	5,297,000
Woods Hole, Eel Pond	941,000
Great Harbor	7,249,000
Total	235,422,000

FLATFISH.

Massachusetts:	
Beverly, Atlantic Ocean	12,827,000
Massachusetts Bay	7,248,000
Falmouth, Buzzards Bay	8,674,000
Little Harbor	6,602,000
Waquoit Bay	11,573,000
Woods Hole, Great Harbor	7,966,000
Gloucester, Atlantic Ocean	1,960,000
Gloucester Harbor	38,145,000
Lackeys Bay, head, Vineyard Sound	7,892,000

Massachusetts—Continued.	
Manchester, Atlantic Ocean	22,360,000
Rockport, Atlantic Ocean	10,900,000
Salem, Atlantic Ocean	10,950,000
Tisbury, Lagoon Pond	12,720,000
Wareham, Wareham River	4,288,000
Rhode Island:	
Warwick, Greenwich Bay	14,520,000
Total	178,625,000

Details of Distribution of Fish and Eggs—Continued.

HADDOCK.

State, locality, and disposition.	Fry.
Massachusetts:	
East Chop Light, Nantucket Sound	2,499,000

POLLOCK.

State, locality, and disposition.	Fry.
Massachusetts:	
Beverly, Atlantic Ocean	3,591,000
Gloucester, Atlantic Ocean	48,223,000
Manchester, Atlantic Ocean	7,906,000
Marblehead, Atlantic Ocean	6,759,000
Nashewena Island, Vineyard Sound	5,022,000
Rockport, Atlantic Ocean	14,798,000
Total	86,299,000

TAUTOG.

State, locality, and disposition.	Fry.
Massachusetts:	
Hadley Harbor, Buzzards Bay	450,000

LOBSTER.

State, locality, and disposition.	Fry.
Maine:	
Biddeford, Biddeford Pool	2,500,000
Blue Hill, Long Island Harbor	1,500,000
Boothbay, Boothbay Harbor	8,000,000
Boothbay Harbor, Linekins Bay	8,000,000
Bristol, Christmas Cove	3,000,000
Johns Bay	2,500,000
Marsh Island Harbor	3,500,000
New Harbor	2,000,000
Cape Elizabeth, Atlantic Ocean	2,500,000
Cape Porpoise, Cape Porpoise Harbor	2,500,000
Gulf of Maine	1,500,000
Deer Island, Blastons Cove	3,000,000
Penobscot Bay	3,000,000
East Boothbay, Damariscotta River	3,500,000
Eastport, Johnsons Bay	8,000,000
Friendship, Friendship Harbor	3,500,000
Gouldsboro, Corea Harbor	3,000,000
Harpswell, Mackerel Cove	3,500,000
Jonesport, Lakemans Harbor	1,000,000
Kennebunk Port, Kennebunk Beach Harbor	2,500,000
Kittery, Pepperell Cove	3,000,000
Lamoine, Eastern Bay	3,000,000
Matinicus, Matinicus Harbor	4,000,000
Monhegan, Monhegan Harbor	2,000,000
Mount Desert, Cranberry Island Harbor	1,000,000
South West Harbor	1,500,000
Orrs Island, Horse Cove	2,000,000
Lowells Cove	8,000,000
Pemaquid, Pemaquid Harbor	4,000,000
Phippsburg, Horse Island Harbor	2,000,000
Port Clyde, Port Clyde Harbor	2,000,000
Portland, Chebeag Cove	1,500,000
Prospect Harbor, Prospect Harbor	2,000,000
Rockland, Muscle Ridge Sound	2,000,000
Saint George, Atlantic Ocean	3,000,000
South Bristol, Johns Bay	1,000,000
Southport, Outer Boothbay Harbor	5,000,000
Stonington, East Penobscot Bay	5,000,000
Maine—Continued.	
Swan Island, Mackerel Cove	1,000,000
Tenants Harbor, Tenants Harbor	2,000,000
Vinal Haven, Vinal Haven Harbor	7,000,000
Winter Harbor, Winter Harbor	1,000,000
York, Eastern Point Cove	3,000,000
York Harbor	3,000,000
Massachusetts:	
Beverly, Atlantic Ocean	1,100,000
Boston, Boston Harbor	500,000
Massachusetts Bay	3,038,000
Cedar Tree Neck, Vineyard Sound	270,000
Cohasset, Atlantic Ocean	500,000
Gloucester, Atlantic Ocaen	2,875,000
Gosnold, Buzzards Bay	2,077,000
Vineyard Sound	2,028,000
Hull, Atlantic Ocean	500,000
Lanesville, Atlantic Ocean	600,000
Long Neck, Buzzards Bay	732,000
Manchester, Atlantic Ocean	1,300,000
Marblehead, Atlantic Ocean	1,500,000
Nahant, Atlantic Ocean	1,000,000
Plymouth, Cape Cod Bay	2,682,000
Rockport, Atlantic Ocean	3,900,000
Salem, Atlantic Ocean	400,000
Scituate, Massachusetts Bay	1,087,000
Swampscott, Atlantic Ocean	400,000
Woods Hole, Woods Hole Harbor	1,939,000
New Hampshire:	
Hampton, Atlantic Ocean	400,000
Newcastle, Atlantic Ocean	200,000
Rye, Atlantic Ocean	400,000
Seabrook, Atlantic Ocean	750,000
Rhode Island:	
Wickford, Rhode Island Fish Commission	231,000
Washington:	
Argo, Puget Sound	30
Friday Harbor, Puget Sound	184
Richardson, Puget Sound	30
Seattle, Puget Sound	250
Total	[a] 167,909,494

[a] The last four items in this column represent adult lobsters transplanted from the east coast.

THE FISHERIES OF ALASKA IN 1907

By Millard C. Marsh

Agent at the Salmon Fisheries of Alaska

and

John N. Cobb

Assistant Agent

Bureau of Fisheries Document No. 632

PREFACE.

While the duties of the agents at the salmon fisheries of Alaska have primarily to do only with the various phases of the salmon industry, the work affords opportunity for a survey of the other fisheries as well. This opportunity was turned to advantage by the present assistant agent upon his appointment in 1905, and his observations were published as a separate special report in addition to the salmon inspection report. For 1906 the two reports were brought together under one cover, but retained distinct identity. "The fisheries of Alaska for 1907," however, is a single report under coauthorship of the agent and assistant agent, combining the report of salmon inspection with statistical data and other observations upon all the commercial fisheries of the district.

GEO. M. BOWERS,
Commissioner.

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THE FISHERIES OF ALASKA IN 1907.

By Millard C. Marsh,
Agent at the Salmon Fisheries of Alaska,
and
John N. Cobb,
Assistant Agent.

SUMMARIZED STATISTICS.

As in the reports for 1905 and 1906, the District of Alaska is considered in the four geographic sections generally recognized, as follows: Southeast Alaska, embracing all that narrow strip of mainland, and the numerous islands adjacent, from Portland Canal northwestward to and including Yakutat Bay; central Alaska, the region on the Pacific, or south side, from Yakutat Bay westward, including the Aleutian chain; western Alaska, the shores of Bering Sea and islands in this sea; and arctic Alaska, from Bering Strait to the Canadian border.

With the exception of arctic Alaska and a portion of western Alaska, all of the fishing localities were visited by one or the other of the agents. Statistics of the yield of fur seals from the Pribilof Islands were obtained through the courtesy of the agent at the Fur Seal Islands, while figures for the other aquatic furs (except the coast fur seals and sea otter) and skins, also the whalebone, walrus ivory, heads, teeth, and hides, were obtained from the custom-house records at Juneau.

By far the greater part of the fishery products of Alaska are marketed outside the district, but a steadily increasing local demand is developing, although it absorbs as yet but an insignificant part of the whole. Salmon, cod, and halibut have been and are yet the principal elements in the yield, but more and more attention is being paid each year to the other fishery resources, although many of these are still totally neglected.

EMPLOYEES.

The number of persons employed in the fisheries of Alaska in 1907 was 12,752, of whom 4,829 were engaged directly in fishing, 7,277 in the canneries, salteries, and at other shore work, and 646 employed on the transporting vessels. This total is a gain of 395 over the number employed in 1906. The fact that the fishermen act as sailors on the transporting ships to and from the salmon canneries and salteries explains the small number of transporters shown in the table.

Southeast Alaska leads in the number of fishermen and transporters, and western Alaska in the number of shoresmen. In the total number of persons employed western Alaska is first by a small margin over southeast Alaska. Whites predominate in fishing and transporting, while Chinese are in the lead as shoresmen, although the Japanese are rapidly gaining over the latter. The number of natives employed shows an increase over both 1905 and 1906.

Employees in the Alaska Fisheries in 1907.

How engaged.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	856	676	1,511	3,043
Indians	1,468	169	128	1,765
Japanese	21			21
Total	2,345	845	1,639	4,829
Shoresmen:				
Whites	532	245	951	1,728
Indians	1,046	144	301	1,491
Chinese	726	471	1,009	2,206
Japanese	311	268	1,273	1,852
Total	2,615	1,128	3,534	7,277
Transporters:				
Whites	258	163	173	594
Indians	50	2		52
Total	308	165	173	646
Grand total	5,268	2,138	5,346	12,752

INVESTMENT.

The total investment in the fisheries was $9,216,028, an increase of $380,570 over 1906. The item of cash capital was eliminated in the 1906 report, and this year the item of outfit for fishing and transporting vessels also is cut out. This outfit included fuel, food, bait, boats, and other vessel equipment, the first three items of which have been left out of consideration altogether; the value of boats and working gear has been included with the value of the vessels.

INVESTMENT IN THE ALASKA FISHERIES IN 1907.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Fishing vessels:								
Steam and other power..	13	$83,660	....	....	....	....	13	$83,660
Tonnage............	222	....	....	....	....	....	222	....
Sailing................	15	11,907	5	$16,750	1	$2,300	21	30,957
Tonnage............	145	....	209	....	37	....	391	....
Transporting vessels:								
Steam and other power..	82	413,720	25	247,200	43	612,552	150	1,273,472
Tonnage............	1,693	....	1,223	....	2,609	....	5,525	....
Sailing................	6	183,300	13	249,150	26	587,500	45	1,019,950
Tonnage............	7,806	....	12,533	....	33,646	....	53,985	....
Boats....................	1,232	152,523	632	77,438	912	284,875	2,776	514,836
Apparatus, vessel fisheries:								
Purse seines............	2	1,700	....	....	....	....	2	1,700
Lines..................	....	5,460	....	400	....	....	....	5,860
Guns....................	....	....	20	240	20	240	40	480
Apparatus, shore fisheries:								
Haul seines..............	98	23,965	56	16,895	....	....	154	40,860
Purse seines............	123	47,969	....	....	....	....	123	47,969
Gill nets................	384	57,660	74	9,400	795	59,603	1,253	126,663
Dip nets................	12	14	....	....	....	....	12	14
Traps....................	43	119,850	17	25,550	18	22,880	78	168,280
Lines....................	....	6,844	....	3,215	....	....	....	10,059
Spears..................	200	150	....	....	....	....	200	150
Shore and accessory property	....	1,945,507	....	1,295,768	....	2,649,843	....	5,891,118
Total................	....	3,054,229	....	1,942,006	....	4,219,793	....	9,216,028

PRODUCTS.

The total quantity of products secured was 178,358,301 pounds, valued at $10,160,183, a gain of 10,949,848 pounds and $1,089,093 over 1906. Except for fertilizer, oil, furs, and skins, the weights shown are round weights, or the weight of products when first taken from the water. The weights of prepared products are shown in the subsidiary tables of the report. Smelt appear in the table for the first time this year. Whalebone and walrus ivory, teeth, hides, and heads are the only products reported from arctic Alaska. As has been stated in previous reports, it was found an impossibility to secure even approximate data as to the persons engaged or the investment in the hunting of aquatic animals (except sea otter and fur seals), which is general among the natives.

PRODUCTS OF THE ALASKA FISHERIES IN 1907.

Products.	Southeast Alaska.		Central Alaska.		Western Alaska.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black cod:						
Fresh........................	17,051	$769	....	....	....	....
Frozen........................	370	15	....	....	....	....
Salted........................	23,933	745	....	....	....	....
Cod:						
Fresh........................	8,000	400	....	....	....	....
Salted........................	....	....	6,006,794	$146,252	....	....
Tongues, salted..............	....	....	1,300	120	....	....
Eulachon:						
Fresh........................	4,000	240	....	....	....	....
Dried........................	48	4	....	....	....	....
Salted........................	8,580	249	....	....	....	....
Smoked........................	100	7	....	....	....	....
Halibut:						
Fresh........................	3,630,256	109,293	4,500	225	....	....
Frozen........................	375,000	15,286	....	....	....	....
Fletched......................	482,362	16,172	....	....	....	....

PRODUCTS OF THE ALASKA FISHERIES IN 1907—Continued.

Products.	Southeast Alaska.		Central Alaska.		Western Alaska.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Herring:						
Fresh	731,250	$4,875	12,000	$360		
Salted	1,621,280	7,126	84,000	2,670		
Smoked	30,587	780				
Eggs, dried	600	20				
Redfish	5,100	255				
Salmon:						
Fresh—						
Coho, or silver	20,500	935				
Dog, or chum	8,000	320				
Humpback, or pink	10,000	600				
King, or spring	403,031	17,402				
Sockeye, or red	96,599	5,010				
Frozen—						
Coho, or silver	23,968	2,397				
Dog, or chum	21,249	2,124				
Sockeye, or red	10,150	609				
Canned—						
Coho, or silver	4,070,325	233,804	1,068,060	57,980	824,880	$45,600
Dog, or chum	9,810,255	407,369			3,081,750	140,388
Humpback, or pink	37,313,145	1,708,441	717,050	32,458	1,277,080	58,381
King, or spring	89,250	5,353	1,004,850	60,291	1,945,580	116,074
Sockeye, or red	10,812,025	779,265	33,807,760	2,191,994	46,038,090	2,943,968
Mild cured—						
Coho, or silver	47,460	1,751				
Dog, or chum	36,000	610				
Humpback, or pink	51,200	960				
King, or spring	1,460,162	88,763	215,710	14,250		
Pickled—						
Coho, or silver	311,516	10,481	178,933	6,710	16,800	630
Dog, or chum	77,667	1,670			7,133	196
Humpback, or pink	1,242,733	30,572			7,100	212
King, or spring	3,733	248	45,866	2,580	207,333	7,856
Sockeye, or red	136,136	5,488	511,200	19,962	3,451,066	121,937
Dry salted—						
Dog, or chum	143,440	1,505				
Smoked—						
Dog, or chum	71,505	1,042				
Sockeye, or red			20,000	500		
Salmon bellies, pickled:						
Coho, or silver			152,800	2,696		
Humpback, or pink	1,440,400	21,080				
King, or spring			23,200	348	43,600	654
Sockeye, or red			712,000	12,644		
Smelt	4,500	225				
Trout:						
Dolly Varden	40,000	1,850	8,000	480		
Rainbow	11,900	808				
Steelhead—						
Fresh	2,100	105				
Frozen	8,328	666				
Salted					1,866	79
Fertilizer:						
Herring	1,014,000	17,190				
Salmon	176,000	2,980				
Oil:						
Herring	612,615	16,336				
Salmon	105,922	2,825				
Shark			300	30		
Whale	83,062	2,879				
Clams	4,500	225				
Crabs	1,700	75				
Aquatic furs and skins:						
Beaver	255	1,445	300	1,513	604	3,196
Muskrat	1	2	193	156	617	356
Otter—						
Land	875	3,871	1,310	4,322	1,297	4,502
Sea	5	500	60	3,058	15	450
Seal—						
Fur	2,430	9,042	150	500	89,784	475,107
Hair	8,898	2,074			66,519	11,280
Walrus:						
Ivory	200	30	56	28	4,378	2,898
Teeth						
Heads						
Whalebone					6,797	32,585
Beaver castors	3	6	1	2	18	25
Fur seal meat, dried					2,333	70
Total	76,756,260	3,547,169	44,576,393	2,562,129	57,074,640	3,966,415

PRODUCTS OF THE ALASKA FISHERIES IN 1907.

Products.	Arctic Alaska. Pounds.	Arctic Alaska. Value.	Total. Pounds.	Total. Value.
Black cod:				
Fresh			17,051	$769
Frozen			370	15
Salted			23,933	745
Cod:				
Fresh			8,000	400
Salted			6,006,794	146,252
Tongues, salted			1,300	120
Eulachon:				
Fresh			4,000	240
Dried			48	4
Salted			8,580	249
Smoked			100	7
Halibut:				
Fresh			3,634,756	109,518
Frozen			375,000	15,286
Fletched			482,362	16,172
Herring:				
Fresh			743,250	5,235
Salted			1,705,280	9,796
Smoked			30,587	780
Eggs, dried			600	20
Redfish			5,100	255
Salmon:				
Fresh				
Coho, or silver			20,500	935
Dog, or chum			8,000	320
Humpback, or pink			10,000	600
King, or spring			403,031	17,402
Sockeye, or red			96,599	5,010
Frozen—				
Coho, or silver			23,968	2,397
Dog, or chum			21,249	2,124
Sockeye, or red			10,150	609
Canned—				
Coho, or silver			5,963,265	337,384
Dog, or chum			12,892,005	547,757
Humpback, or pink			39,337,275	1,799,280
King, or spring			3,039,680	181,718
Sockeye, or red			90,657,875	5,915,227
Mild cured—				
Coho, or silver			47,460	1,751
Dog, or chum			36,000	610
Humpback, or pink			51,200	960
King, or spring			1,675,872	103,013
Pickled—				
Coho, or silver			507,249	17,821
Dog, or chum			84,800	1,866
Humpback, or pink			1,249,833	30,784
King, or spring			256,932	10,684
Sockeye, or red			4,098,402	147,387
Dry salted—				
Dog, or chum			143,440	1,505
Smoked—				
Dog, or chum			71,505	1,042
Sockeye, or red			20,000	500
Salmon bellies, pickled:				
Coho, or silver			152,800	2,696
Humpback, or pink			1,440,400	21,080
King, or spring			66,800	1,002
Sockeye, or red			712,000	12,644
Smelt			4,500	225
Trout:				
Dolly Varden			48,000	2,330
Rainbow			11,900	808
Steelhead				
Fresh			2,100	105
Frozen			8,328	666
Salted			1,866	70
Fertilizer:				
Herring			1,014,000	17,190
Salmon			176,000	2,980
Oil:				
Herring			[a] 612,615	16,336
Salmon			[b] 105,922	2,825
Shark			[c] 300	30
Whale			[d] 83,062	2,879

[a] Represents 31,682 gallons.
[b] Represents 14,123 gallons.
[c] Represents 60 gallons.
[d] Represents 1,625 gallons of crude and 9,450 gallons of pressed oil.

PRODUCTS OF THE ALASKA FISHERIES IN 1907—Continued.

Products.	Arctic Alaska.		Total.	
	Pounds.	Value.	Pounds.	Value.
Clams			a 4,500	$225
Crabs			b 1,700	75
Aquatic furs and skins:				
Beaver			c 1,159	6,154
Muskrat			d 811	494
Otter—				
Land			e 3,482	12,695
Sea			f 80	4,008
Seal—				
Fur			g 92,364	484,649
Hair			h 75,417	13,354
Walrus	475	$100	i 475	100
Walrus:				
Ivory	3,555	2,661	8,189	5,617
Teeth	5	4	5	4
Heads	80	50	j 80	50
Whalebone	18,880	81,655	25,677	114,240
Beaver castors			22	33
Fur-seal meat, dried			2,333	70
Total	22,995	84,470	178,358,301	10,160,183

a Represents 450 bushels.
b Represents 566 crabs.
c Represents 1,159 skins.
d Represents 6,481 skins.
e Represents 1,393 skins.
f Represents 16 skins.
g Represents 15,394 skins.
h Represents 25,139 skins.
i Represents 19 skins.
j Represents 4 heads.

THE SALMON INDUSTRY.

Taken as a whole, the season of 1907 was an excellent one. The run, except in the Nushagak, was very good, while the prices realized for the prepared products were exceptional. The following is a list of the plants operated during the season of 1907:

Name.	Location.
Southeast Alaska:	
Canneries—	
Alaska Packers Association	Pyramid Harbor, Wrangell, and Loring.
Northwestern Fisheries Co	Quadra, Hunter Bay, Santa Ana, and Dundas Bay.
North Pacific Trading and Packing Co	Klawak.
Pacific Coast and Norway Packing Co	Petersburg.
Metlakahtla Industrial Co	Metlakahtla.
Columbia Canning Co	Chilkoot Inlet.
Thlinket Packing Co	Funter Bay.
Pillar Bay Packing Co	Pillar Bay.
Yakutat and Southern Railway Co	Yakutat.
F. C. Barnes	Lake Bay.
Geo. T. Myers & Co	Sitkoh Bay.
Shakan Salmon Co	Shakan.
John L. Carlson, lessee	Taku Harbor.
Fidalgo Island Packing Co	Ketchikan.
Gorman & Co	Kasaan.
Pacific-American Fisheries	Chilkat Inlet.
C. A. Burckhardt & Co	Yes Bay.
Salteries, etc.—	
Juneau Packing Co	Juneau.
John H. Mantle	Etolin Island.
Fred. Brockman	Sarkar.
James Thompson	Skowl Arm.
John Baronovich	Do.
Alex. Millar	Nakat Inlet.
H. E. Heckman	Point Higgins.
Mrs. A. E. King	Sunny Point.
Alaska-American Fish Co	Pleasant Bay.
Rasmus Engee	Stikine River.
Alaska Fish and Herring Co	Wrangell Narrows.
Globe Fishing and Packing Co	Dall Island.
Pacific Cold Storage Co	Taku Harbor.

Name.	Location.
Southeast Alaska—Continued.	
Salteries, etc.—Continued.	
A. H. Sonsthagen	Cape Fanshaw.
Coulter Bros	Wrangell.
W. C. Waters	Holbrook.
H. Bergman	Ketchikan, Douglas, Klawak, etc.
Oliver Drange	Juneau.
Taku Fish and Ice Co	Douglas.
Walter S. Elwell	Juneau.
Alsek Fisheries Co	Alsek River.
Thos. L. Fay	Ketchikan.
Knutson Bros	Wrangell Narrows.
A. W. Malstrom	Taku Harbor.
Peter Summers	Stikine River and Wrangell Narrows.
W. Alter	Ketchikan.
International Fisheries Co	Tee Harbor.
Hunt-Lathrop Co	Ketchikan.
Frye-Bruhn Co	Do.
Central Alaska:	
Canneries—	
Alaska Packers Association	Chignik Lagoon, Alitak Bay, Karluk, and Kasilof.
Northwestern Fisheries Co	Chignik Bay, Uyak Bay, and Orca.
Salteries—	
Alaska Commercial Co	Kodiak.
Blodgett & Blinn	Do.
J. A. Herbert	English Bay.
San Juan Fishing and Packing Co	Kenai.
Western Alaska:	
Canneries—	
Alaska Packers Association	Nushagak Bay, Kvichak Bay, Naknek River, and Ugaguk River.
Northwestern Fisheries Co	Nushagak Bay.
North Alaska Salmon Co	Nushagak Bay, Kvichak River, Lockenuck River, and Ugaguk River.
Naknek Packing Co	Naknek River.
Alaska Fishermen's Packing Co	Nushagak Bay.
Red Salmon Canning Co	Ugashik River.
Columbia River Packers Association	Nushagak Bay.
Alaska-Portland Packers Association	Do.
Alaska Salmon Co	Wood River.
L. A. Pedersen	Kvichak Bay.
Salteries—	
Peter Nelson	Igushik River.
Northwestern Packing Co	Kvichak Bay.
Lagoon Salmon Co	Nelson Lagoon.

An unusual phenomenon was noticed this year in the sea water about the west coast of Prince of Wales Island and vicinity by residents of this region. It began to be observed about the 1st of August, or perhaps earlier in some places, and disappeared the latter part of the month or early in September. A white turbidity, or so-called milkiness, spread throughout large areas of sea water near the land, but, as far as reported, was not seen in the fresh water nor far out at sea. The appearance was said to be striking and, though it varied somewhat in color or intensity, was not to be confused with the turbidity caused by glacial streams, being much whiter in color. The bays and channels from Dixon Entrance to Klawak were more or less affected, and it was especially noted in Cordova Bay, Sukkwan Channel, and Nutqua, Hetta, and Klakas inlets, while Hunter Bay was nearly clear. Sea Otter Bay, on the west side of Dall Island, is the only locality next the open sea where the color was reported. One

side of this bay was said to be very milky, while the other side was clear. Accounts vary with respect to the nature of the turbidity, whether caused by a sediment which would settle out when the water was allowed to stand or whether the material was in solution, but the former is more likely. The condition was so pronounced that in a bucket filled with the water the bottom could not be seen. Fresh rain water was said to show clear on top of the milky water.

It is claimed that an earthquake shock was felt by the people at Sulzer, Copper Mount, and other places about a week before the unusual condition of the water appeared. Old residents of the region seem not to recall any previous manifestation similar to this one, and no one has a satisfactory explanation of the occurrence. No samples of the water were saved and the condition was not seen by the present writers; during the visits of the agent to the west coast of Prince of Wales in July and again in October the water was in its usual condition. It is likely that had there been investigation or full reports other localities would have been found affected. The Naas River, for instance, was said to have been involved, and about the 1st of October a murkiness in the water was seen between Nichols Pass and Ketchikan which was taken to be of the same nature, though less in degree, as the condition near the west coast of Prince of Wales Island.

Whatever may have been the cause of the phenomenon, the fishermen are firmly of the opinion that the milky water had a pronounced effect on the salmon run. Few fish were taken in it, and the scarcity of redfish between Klawak and Hunter Bay is believed to be due in part at least to this extraordinary condition. Such catches as were obtained in this region were taken in clear water, and north of Klawak on Prince of Wales Island, where the water did not become clouded, there was a fairly good run of redfish. The few salmon seen in the cloudy water were scattered and seemed to be stragglers which had become lost.

On August 14, 1907, the Japanese schooner *Satsuma Maru* (185 net tons), of Tokyo, Y. Fuji, master, and S. Satsuma Company, Tokyo, owners, anchored close to Killisnoo, and on the 19th her captain entered the vessel at the custom-house in Sitka. She carried a crew of 27 men, had a cargo of 140 tons of salt, and expected to buy dog salmon for salting, as other Japanese vessels have done in previous years. She had no clearance papers, however, and arrived so near the end of the fishing season that she was in any case unable to accomplish this purpose. Late in the year she was wrecked in the vicinity of Yakutat and entirely lost, her crew escaping, however.

The Indians of Alaska are an important factor in labor conditions, the cannery men drawing upon them for a very considerable portion of their force and frequently employing a whole village during the salmon season. The jealousies between the tribes, however,

and various racial traits on all sides among the laborers are the occasion of a variety of complications. An occurrence this summer gave evidence of the possibility of trouble that lies in failure to observe the customs governing the Indians in their fishing operations. A crew from the Sitka tribe fished for the Sitkoh Bay cannery in Redoubt Bay, a short distance south of Sitka, until early in September, when they stopped, giving the scarcity of fish as a cause. Upon this the superintendent of the cannery sent over a crew of Killisnoo Indians to fish the bay. The Sitka Indians, however, claim the exclusive right to fish there and resented the coming of the Killisnoo crew, who, fully cognizant of their situation, refused to remain in camp on the bay, insisting on being carried back to the cannery with each trip of the launch. But for this and the lateness of the season, disorder and possibly bloodshed could not have been averted.

The Indian village of Uguiak, a few miles inside of the mouth of Alitak Bay, was raided in June this year, when, as usual during the canning season, the inhabitants were living in temporary quarters at the cannery at the head of the bay some 15 miles distant. The raiders, who were the crew of a Japanese sealing schooner, broke open and looted the houses, carrying off furniture, bedding, clothing, etc., and extended the outrage also to a Russian church in the village. Here they had gathered the church vestments and ornaments into a pile in the middle of the nave, preparatory to removing them, when the appearance of several canoes containing Indians from the cannery frightened them away. The schooner left before the Indians could learn her name, which is most unfortunate, as there are a number of Indian villages along the coasts of Alaska similarly deserted and unprotected during the canning season, and the success of the first raid may lead to a repetition of the crime. The safety of these villages is a matter of interest to cannery men as well as to the Indians themselves. If the latter can not leave their property without fear of depredation, they will remain at home to protect it; and not only would their own earning capacity be thus seriously impaired, but the cannery men would be compelled to bring in a larger force of other labor, with all the difficulties and expense of transportation in addition to the cost in higher wages.

The location of possible future hatcheries was a subject to which attention was given during the inspection at favorable places, at Chilkoot Lake especially. The observations are reported at length in subsequent pages, with other notes regarding these localities. The question of fishing with gaff hooks by Indians who sell their catch to the canneries, a practice noted last year as existing in Chilkoot River, still obtains. It likewise is discussed later in this report.

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SOUTHEAST ALASKA.

The redfish run was in general a very poor one in southeast Alaska, the total catch falling about 13 per cent below that of 1906, which was itself a bad year. Nevertheless, a few localities, as Boca de Quadra and Salmon Bay, had unusually good runs. In the Ketchikan district the run was said to be late in appearing, but while it was late in comparison with the preceding season, it was probably not much behind the average of recent years.

The humpback run on the other hand was a very good one and most of the canneries completed their packs with this salmon, filling cans which were intended for redfish at the beginning of the season.

LOCAL CONDITIONS.

Boca de Quadra.—This cannery was operated for the first time since 1902. Quadra has been one of the most important redfish streams in southeast Alaska, and yields fish of large size. This season it was heavily fished by 2 outside canneries as well as the local, some 30 seines in all operating during part of the season. Until late in August there was no very important run of redfish, but they came then in abundance and Quadra Stream finally yielded considerably more than twice as many redfish as any other single bay or stream in southeast Alaska. A gasoline-motor seine boat, which not only propelled itself but also pursed the seine by power, was operated here this year.

Ketchikan Creek.—This is a humpback stream and generally the run of fish is very large. In 1906, however, it was exceedingly small, and the Fidalgo Island Packing Company, which usually secures a considerable quantity of fish by means of seines hauled just inside the mouth of the creek, made but one haul during the whole season and that netted only 156 fish. In 1907 the run was exceptionally heavy. As long as high water prevails most of the fish manage to mount the falls a short distance from the mouth, but when the water is low, as occasionally happens during the summer months, the fish find trouble in ascending, and many die in the attempt. The erection of a fish ladder at this point, or the removal of a few of the larger rocks which form the principal obstacle to the ascent of the salmon would greatly aid the fish in their up-stream rush. As this stream is the only one in Alaska that is easily accessible to tourists, and is visited by thousands of them every year, for this reason, if for no other, it should be kept in the best condition possible. A favorite pastime of certain idle visitors seemed to be to visit the creek and stone the fish on the spawning beds, but this was effectually stopped by the announcement that persons so offending would be prosecuted.

The creek between the village and the dam above the power house, which marks the limit of the ascent of salmon, was visited many

times during the run of humpbacks for the purpose of observing the fish. The most interesting point was at the village falls. Here scarcely an instant of time elapsed that did not witness one or more salmon attempting the leap to clear the falls. Apparently nearly every salmon made many unsuccessful attempts before finally overcoming the obstacle, as they were constantly seen to fail and fall back with the swift rush of water. Below the falls the congregation of fish seemed to have reached its limit. They were packed in almost solidly, their bodies in contact, evidently several fish deep in the water, the upper ones wriggling over the bodies of those beneath as they constantly headed upstream and breasted the current in their endeavor to reach the falls. During August and early in September this run is at its height. On October 7, after seven weeks, the creek was again visited. A marked change in conditions had occurred. Now many fish were dead and distributed along the banks of the creek, in and out of the water, which was tinged with brown. The creek still contained many living fish, but they were greatly changed in appearance, many in a dying condition or in the frantic movements of the death agony, and showing the usual characters of spent salmon. Nearly all had deposited their eggs. On October 16 the number of salmon still living had still further, and very greatly, diminished. Many of the dead were completely enveloped in fungus, and the bodies of some had been nearly consumed by it. Though the spawning season had been practically over for some time, and many millions of eggs must have been deposited, an inspection of the bottom of the creek did not reveal many live eggs exposed to view. Many dead eggs were to be seen, largely collected into heaps by the eddies. Under the stones were found many eggs both living and dead, and many of the living eggs were eyed (October 16), and the movements of the embryo could be seen when the egg was broken. The temperature of the creek was 47° F. Between the power house and the dam no fish were seen and none were leaping at the dam. In August they could be seen attempting to get over this inaccessible fall.

Notwithstanding the great run of salmon, apparently packing the creek so solidly that its full reproductive capacity must be reached, the impression in October, resulting from a search for eggs, is that the creek could sustain many more than appear to exist.

An occasional redfish in spawning color may be seen during August among the humpbacks, and in October a few cohos are taken with the gaff.

Yes Bay.—There was a very scant run of redfish in Yes Bay in the earlier part of the season, and the superintendent of the Government hatchery at Yes Lake, fearing for his supply of spawning fish, partly closed the bay to fishing. The conditions not improving, early in

August he closed it entirely, and it was not reopened during the fishing season. Salmon reached the head of Yes Lake in sufficient numbers to fill the present capacity of the hatchery, the take being 65,550,000 eggs, which was 7,340,000 more than in 1906. The last eggs of the season were taken on September 28. About 2,000,000 more eggs might have been secured at this time, but there was no large excess of spawning fish beyond the demands of the hatchery, and the closing of the bay had apparently proved a wise and necessary measure. The commercial catch, together with the hatchery take, shows that finally a substantial though not large run of redfish must have entered Yes Bay.

Kasaan Bay.—The Kasaan Bay cannery, which was destroyed by fire at the end of the season of 1906, was rebuilt this year and made some of the best catches of the region early in the season, securing a full pack by the time it closed in the fall. Early in the season the fishery in Karta Bay was thought to be a failure, for Karta Stream has one of the earliest runs in southeast Alaska, and though heavily fished was not producing well. The total catch from Karta Bay, however, showed a substantial yield of redfish for the season. More than 20 seines were operated in and about Karta Bay, belonging to two outside canneries and the local.

Lake Bay.—On July 20 all five species of salmon were represented on the cannery floor. The kings were in small numbers and had been taken in Bradfield Canal. Some dog salmon brought in later had flesh of a pronounced pink color, deeper in hue than that of the humpbacks.

There are two salt lagoons between the bay and the fresh water, which is about 10 miles distant, but redfish have been observed to reach the latter early. About 1,000 were said to have been seen there about July 1, and on July 21 there were a few in the stream, evidently making their way slowly to the lake above. They had not yet taken on the red color. It is believed by fishermen that these early fish which disappear from the stream return to salt water instead of proceeding on to the lake.

Petersburg.—The Pacific Coast and Norway Packing Company purchased this location and removed from Tonka last spring. Numerous improvements have already been made and a new transporting boat, fitted to burn oil, was put into commission this year. It is the intention to install a cold-storage plant at an early date. There is now a considerable resident population at Petersburg, largely engaged in fishing and lumbering, and a town site was surveyed during the summer.

Lynn Canal.—Owing to the large falling off in recent years in the run of red salmon in Lynn Canal and its two principal tributaries, the Chilkat and Chilkoot rivers, the cannery men located in this section

have been compelled to go farther and farther away each season in order to secure sufficient salmon to operate their plants. Two of the canneries have a number of traps set in Icy Strait, some 80 miles away, and depend upon these for the greater part of their fish, but they have found the long haul quite expensive, and after the season had closed the Pacific-American Fisheries, which operated a cannery in Chilkat Inlet, erected a new cannery in Excursion Inlet, an arm of Icy Strait, close to the location of the traps. The company intends to retain the old cannery intact and use it should the necessity arise.

In last year's report mention was made of an objectionable practice in the Chilkoot and occasionally in the Chilkat River, namely, the fishing of the Indians of the neighborhood, who take large numbers of red salmon with gaff hooks and sell the catch to the three canneries operated in the vicinity. As stated above, the run of red salmon in this section has been growing less and less each season, and it would seem that after the fish have run the gauntlet of the numerous traps and nets in Lynn Canal and the Chilkoot and Chilkat inlets they should be permitted unobstructed passage up these narrow rivers to the spawning beds in the lakes at the head. As the fish are in a somewhat advanced spawning condition at the time of capture, and are frequently badly torn by the action of the gaffs, they are not of much value to the cannerymen. The latter claim that they purchase them only because of the fear of incurring the ill will of the Indians, and that they would welcome an order of the Department closing both streams to all commercial fishing.

It does not seem possible that it was the intention of the framers of the Alaska salmon law to permit the use of spears, gaffs, and hooks in rivers the size of these when the salmon are taken in such large numbers and sold to canneries, the original intention doubtless being to allow the Indians to secure only enough salmon by this means to satisfy their own domestic needs; and these two rivers are the only ones in Alaska in which this objectionable practice obtains. But since the rod, spear, and gaff are excepted in the provisions of the act for protection of the Alaska fisheries, apparently no remedy is open to the Department without an amendment to the law. The canneries, however, have it in their power to stop the practice by declining to purchase the fish.

About two weeks during the latter half of September were devoted to an examination of the shores of Chilkoot Lake and the streams entering it, with a view of locating the spawning grounds of the redfish and finding possible hatchery sites adjacent to proper water supplies.[a] Spawning redfish were found about the shores of the

[a] The Columbia Canning Company, through its cannery force at Chilkoot, rendered very material assistance in outfitting for and carrying out this trip.

lake and in two small, short tributaries. No other of the dozen or more streams entering the lake except the main inlet, or Chilkoot River, carries red salmon. By far the greater part of the Chilkoot run of redfish ascend the main inlet and apparently do not spawn in the vicinity of the lake, but far up the stream, beyond observation at the time—the glacial turbidity of the water making observation of salmon difficult. At the end of September it did not appear that the height of the spawning season had yet been reached. Near the head of the lake there are considerable springs, making a large pool about 125 feet in diameter, which has admirable spawning bottom and held a few hundred spawning or nearly ripe salmon. These springs deliver sufficient clear water (temperature on September 21, 41½° F., or 2½° colder than the lake) to operate a large salmon hatchery. The shores of the lake or the few spawning pools adjacent do not furnish an adequate supply of ripe salmon, but eggs could be obtained in quantity by barricading the main inlet at or near its mouth and holding the fish to ripen in the lake, whose shores in this vicinity afford admirable seining ground. The current at the mouth of the inlet, however, is strong, and to be efficient a barricade would have to be of the most substantial sort.

The springs mentioned would not furnish a gravity flow for a hatchery. The supply would, however, probably never freeze. On the west (southwest) shore of the lake there are at least two clear streams from which a gravity flow could be obtained through a short conduit; but it is doubtful whether these streams remain open throughout the winter. The spawn would have to be brought from the head of the lake.

This examination of Chilkoot Lake included a variety of observations on spawning habits, temperature of salmon, hemoglobin content of the blood of nearly ripe salmon, and other records of a miscellaneous nature, which data will be held for future publication, together with the results of continued studies.

Dundas Bay.—The success of the season for the cannery of the Northwestern Fisheries Company at Dundas Bay was seriously interfered with by a costly accident on August 2, when the main warehouse, in which were stored 14,000 cases of this year's pack, the season's labels and box shooks, also fishing gear, collapsed and fell into the bay. The box shooks, fishing gear, and some of the salmon were saved, but 4,000 cases of salmon, mostly pinks, were lost, also all of the labels. The building itself was a total wreck, and two Chinese were drowned.

Alsek River.—For some years cannery men, attracted by the Indian reports of large runs of salmon in this river, have cast longing eyes upon it, and several have made short prospecting trips thither. This year a company was organized, composed mainly of Alaskans and known as the Alsek Fisheries Company, and an outfit for mild-curing

king salmon was sent to the Alsek. After several futile efforts and much danger, with the loss of several weeks' time, the party finally got inside on May 12, and by the 15th were ready to fish. The run of kings had been on for some time, however, and very few were taken after June 1. It was noticed by the fishermen that the fish did not linger long in the delta and lower reaches of the river proper, owing probably to the very rapid current of the river. The white-meated kings averaged fewer than 1 in 10. The largest one taken weighed 52 pounds, while the average was about 33 pounds.

After June 1 the fishermen began catching sockeyes. The roe in these fish did not seem to be very far advanced, and it was thought that possibly the fish went up the river to where slack water may be found and there waited until ripe. Eulachons were found in the stomachs of some of the fish, showing that they were still feeding. There is quite a run of eulachons into the Alsek in May.

The physical conditions in and around the Alsek River delta are very discouraging to the fisherman. This delta, or Dry Bay, as it is also called, is about 20 miles northwest of Cape Fairweather and about 60 miles southeast of the southern entrance to Yakutat Bay. Here the coast range of mountains lies back from the shore line from 6 to 14 miles, leaving low, wooded ground, which is drained by numerous streams. The Alsek River drains the great ice fields north of the St. Elias and Fairweather ranges, one branch dipping around to the westward and tapping the St. Elias region, and another branch extending more to the northward into the Chilkat country. The river breaks through the range back from Dry Bay, and after cutting a large glacier lying near the northern end of the bay, forms its delta of three separate channels and outlets to the sea, all of this bearing the name of Dry Bay. The river itself has a very rapid current, making the handling of nets and boats a difficult matter, while the three channels composing the delta are filled with bars and small islands with ramifying channels, all changing from day to day. About the best water for entering the delta is 6 feet at mean low tide. Storms are frequent along this stretch of coast, and the tremendous surf engendered, together with the quite narrow entrances to the delta, make it a very difficult matter to get in except when the weather is calm, while it is an impossibility in even moderately breezy weather.

Yakutat.—The cannery of the Yakutat and Southern Railway Company, which is located at this place, was outfitted for 42,000 cases. Red salmon ran small during the whole season, which the fishermen claim is a sign of a good run. King salmon were very scarce, averaging 2 or 3 a day, while in 1906 the average was from 18 to 20 a day.

KING SALMON FISHERY.

The greater part of May and June were devoted by the agents to the fishery for king salmon in southeast Alaska. During the winter and spring months this species is to be found feeding upon the herring, smelt, etc., in most of the bays, sounds, and straits in this section, the chief centers of abundance at this time being Behm and Seymour canals, Auk Bay, and the neighborhood of Klawak. When the time for spawning approaches the fish enter and ascend the Unuk, Stikine, Taku and Alsek rivers, and possibly a few ascend some of the other and smaller streams. The fish are handled mainly by dealers located at Ketchikan, Wrangell, Petersburg, Douglas, and Juneau. During the months of September and October some fishing for feeding kings is carried on in Seymour Canal and a few other places.

There was a very small run of kings in December of 1906. In January and February of this year, two of the best months usually, the weather was so excessively cold, and the ice formed so thick, that the fishermen found it impossible to operate their trolling lines. As soon as the weather moderated and the ice melted, fishing was resumed, but the enforced inaction for two months seriously hampered the fishermen and dealers. Several places, particularly Seymour Canal, report a late run of kings in the spring, which still further decreased the output.

The Taku River and inlet and the Stikine River were the scene of very important fishing operations in May and June, over 100 boats being engaged directly in fishing with gill nets on the Taku alone about the middle of May, and this number was increased later on.

King salmon were in great demand at certain times, owing to competition between the buyers employed by the dealers who shipped the fish fresh to Puget Sound ports and by those who mild-cured them. About the middle of May the prices prevailing in the vicinity of Taku Inlet were as follows: Red-meated kings, 20 pounds and over, 60 cents each; all under 20 pounds, 35 cents each; white-meated kings, 30 cents each without regard to size. On June 26 some of the buyers were paying $1.25 for large red-meated fish (14 pounds and up), and the prices are said to have risen even higher than this in a few instances. Very few kings were to be had at this time, however.

This season for the first time an agent of the Department was on the scene of operations during the net fishing for king salmon, which is carried on in May and June. Earlier than this, as the kings are feeding and do not school, nets are rarely used, but trolling lines instead, and the law permits hook-and-line fishing at all times. Most of the time of observation was given to the Taku as the most important point, where it was found that the fishermen were in ignorance that the laws, especially the portion relating to the weekly closed time,

applied to the king-salmon fishery with nets. An understanding on this point was secured, however, and the last half of the season the law was quite generally obeyed.

The proportion of red to white meated fish varies considerably at different places. On May 17, out of 49 king salmon taken in Auk Bay, 32 were white-meated and 17 red-meated fish, while of 66 fish taken in Taku Inlet on the same date 60 were red-meated. On June 26, out of 67 fish caught in the inlet only 7 were white-meated fish. On the Alsek River, taking the season as a whole, the white-meated fish averaged fewer than 1 in 10. In Cook Inlet the run is composed entirely of red-meated fish.

CENTRAL ALASKA.

Orca.—This cannery, owned by the Northwestern Fisheries Company, is the farthest north, and is every year the first in all Alaska to begin canning. This year the run of fish began quite late and was not heavy at any time throughout the whole season. The cannery was also somewhat hampered by a shortage of labor and the scarcity of good coal. It was found that nearly all of the canneries in southeast and central Alaska suffered, some quite seriously, from the latter cause, there having been virtually a coal famine on the Pacific coast for nearly a year now. All the king salmon were turned over to a mild curer who was located at the cannery, but the run of this species was exceedingly poor, and only 10 tierces were put up. The cannery stopped fishing August 23, with about four-fifths of its pack put up.

Cook Inlet.—This year, in addition to the Kasilof cannery of the Alaska Packers' Association, two salteries were operated—one by the San Juan Fishing and Packing Company at Kenai and the other by Mr. J. A. Herbert at English Bay. The first-named saltery was started primarily for the mild curing of king salmon, and gill nets were employed in the fishery, but they were of 10-inch stretch mesh, which was found to be too large. The Kasilof cannery used 8½-inch stretch mesh and made an exceptionally good catch of kings, all of which were canned. All the kings caught were red meated. After the close of the king-salmon season the San Juan Fishing and Packing Company began salting red and other species of salmon. The company had a trap at East Foreland, on the inlet, and one on the right-hand side of the Kenai River, a few miles up from the mouth, while the Kasilof cannery operated a trap on the left-hand side of the river a short distance from the mouth. Mr. Herbert's saltery was devoted to the salting of red and silver salmon, and seines alone were employed. All three plants had a very successful season.

Kodiak.—In order to give employment during the summer months to as many natives as possible, the Alaska Commercial Company and Blodgett & Blinn furnish seines and pay $35 per 1,000 for all the red

and silver salmon caught, the bellies being cut from these fish and salted. Red salmon are generally taken in Ranch Creek, Kesuyak Bay, Eagle Harbor, and Malinof Straits, while the silver salmon come from Ranch Creek, Malinof Straits, and Kesuyak Bay. Humpback and dog salmon are found in abundance, but are not utilized.

Uyak.—The only cannery at this place is operated by the Northwestern Fisheries Company. Heavy storms in the winter washed away houses on Karluk Spit, where seine crews are installed during the fishing season, and bad weather early in the season materially interfered with fishing operations in 1907. The cannery secured a full pack, however.

Karluk.—The two large canneries operated here are owned by the Alaska Packers' Association. A very good run of fish into the lagoon early in the season soon slackened and for some time the plants were behind their packs of the previous year; but later exceptionally large runs enabled them to make up the deficiency, and to ship, as early as July 30, the first full cargo of salmon to come out of Alaska in 1907. These plants likewise suffered from the previous winter's heavy storms, but not so seriously as the Uyak cannery.

Alitak.—The superintendent of the cannery at this place, which is operated by the Alaska Packers' Association, reports the earliest run of red salmon known in eighteen years; and the run remained so exceptionally heavy that the cannery packed its full outfit for the first time in several seasons.

Chignik.—It had been the intention to make a close inspection of the fish traps located in the lagoon at this place, in regard to which complaint was made in the 1906 report, but it was found impossible, owing to limited transportation facilities, to make the desired investigation here without foregoing the more important trip to the westward. Last year the lagoon was apparently completely blocked with traps, three of which belonged to the Alaska Packers' Association, three to the Northwestern Fisheries Company, and one was owned and operated jointly. The superintendent for the latter company states that the conditions have been remedied this season by changing the location of some of the traps and reducing the leads in others. The run of fish was very good nearly the whole of the season, and prospectors recently come from the lakes are said to have reported them full of salmon. Some dissatisfaction arose this year over the question of Sunday labor. The fishermen refused to work on Sunday except during the actual fishing, and the cannery employees, who receive much smaller wages, claimed the same privilege in vain. Owing to the shortness of the salmon-canning season in central and western Alaska, Sunday work has been universal.

WESTERN ALASKA.

As it was impossible to reach Unalaska before August 4, and fishing in Bristol Bay ends about August 1, personal inspection of the fisheries in the latter region was not feasible. The following data are derived from interviews and correspondence with superintendents of canneries and other persons who spent the season on the ground.

Nelson Lagoon.—The Lagoon Salmon Company, which operates a saltery at this point, in the fall of 1906 suffered the loss of its transporting schooner and, though the cargo was saved, was unable to deliver the pack in San Francisco until the spring, after employees and outfit for the next season were taken to Alaska. The season of 1907 was fairly successful, though the failure to secure new webbing as ordered seriously weakened the efficiency of the saltery trap.

Ugashik River.—Of the four canneries located on this river but one, that owned by the Red Salmon Canning Company, was operated. Fishing was begun on June 15 and continued until July 31. As for the past five or six seasons, the run was small, but was enough to enable one cannery to put up a medium pack. The Bristol Packing Company, of San Francisco, which owns one of the canneries on this river, expects to retire from the business of canning salmon in Alaska.

Ugaguk River.—Both of the canneries located on this river (one owned by the North Alaska Salmon Company and the other by the Alaska Packers' Association) were operated this year, the latter having been closed since 1904. A fair run of salmon entered the river and both canneries secured their guaranties.

Naknek River.—As usual, the run of fish on the Naknek was excellent, and both companies operating here had little trouble packing their guaranties. The Alaska Packers' Association has two canneries on this river, the Naknek Packing Company one.

Kvichak River and Bay.—The two canneries of the North Alaska Salmon Company, the Koggiung cannery of the Alaska Packers' Association, and the saltery of the Northwestern Packing Company were operated this year, but the cannery of the Union Packing Company was closed. A small saltery constructed last year on the coast between the Kvichak and the Naknek by Mr. L. A. Pedersen, formerly superintendent for the Naknek Packing Company, was this season enlarged and, with one line of machinery, was run as a cannery, putting up a small pack. A very fair run of fish passed up the Kvichak, and all the plants put up at least their guaranties, besides sending some fish to canneries on the Nushagak which fell short.

Nushagak Bay.—This was a disastrous year for the Nushagak plants. The season was very backward, cold and foggy weather prevailing, with heavy winds from all but the right direction (a south or southeast wind is said to bring the fish into Nushagak Bay), and the run was one of the lightest ever known. None of the 8 canneries

and 1 saltery secured more than half a pack. Most of the canneries fished quite late, a few fishermen being seen out in the bay as late as August 10. During a considerable part of the season the best fishing was found just outside the bay, but it was impossible for the boats to remain out very long at a time owing to the rough weather. It is reported that after all fishing had ceased a heavy run of red salmon came in.

In order to eke out the inadequate supply of fish on the Nushagak, the North Alaska Salmon Company and the Alaska Packers' Association secured fish from their other canneries on the Kvichak.

One less trap was set in Wood River this year, the Northwestern Fisheries Company thus setting the good example of withdrawing all its fishing gear.

Kuskokwim River.—This stream continues to be of interest to salmon packers as a region of promise, but its inaccessibility has so far discouraged attempts to occupy it. In the summer of 1906 a salting outfit was sent thither by a dealer of Seattle, Wash., but arrived too late for the run of fish. It had been the intention to operate at Eak River, at the head of the bay and just below the mouth of the Kuskokwim, but when it was found that no fishing could be done that season the outfit was cached at the mission station of Bethel. No effort was made to resume the project in 1907, but it will probably be carried out next year. The run in 1906 was very large, and was principally king salmon. About 17 barrels of salted salmon, valued at $170, were bought from the natives that year.

HATCHERIES.

Five salmon hatcheries were operated during the season of 1907–8: The Fortmann hatchery on Naha Stream and the Karluk hatchery on Karluk River, both owned by the Alaska Packers Association; the Klawak hatchery, on Klawak Lake, owned by the North Pacific Trading and Packing Company; the Yes Lake hatchery, on Yes Lake, owned by the United States Bureau of Fisheries, and the Hetta hatchery, on Hetta Lake, owned by the Northwestern Fisheries Company. The latter, which had been closed since the season of 1903–4, was improved and enlarged about one-third, making its present capacity 10,000,000 eggs. The water supply has been protected against freezing, a serious danger, by an underground pipe line about 50 yards long from the point of intake in the creek to the hatchery. The Bureau of Fisheries is now engaged in constructing a hatchery on Afognak Lake, near Litnik Bay, Afognak Island, which will be ready to operate during the season of 1908–9.

Capt. John C. Callbreath's hatchery was operated during the season of 1906–7, but the owner, now totally blind, is no longer able to maintain the establishment. As he is not engaged in the canning or salting

of salmon, he is unable to secure rebates on the fry liberated, and the hatchery thus is operated, and has been for fifteen years, without the slightest possibility of a money return for work or expense, being a heavy outlay in earnest effort to build up the fisheries of that region.

At Fortmann hatchery the month of January was excessively cold, and on the last day of the month a flume supplying water to a portion of the hatchery was frozen solid. About 18,000,000 eggs dependent on this water were removed from the hatchery and placed in a pond, but practically all of them died. To increase the output this fall the hatchery sent a party to Quadra, a distance of 61 miles, and here secured over 6,000,000 eggs, but late advices are to the effect that these do not promise well.

The superintendent of Fortmann hatchery, as a part of his regular campaign against the various enemies of the salmon and destroyers of the eggs in the vicinity of the hatchery and spawning grounds, set a trap of wire netting in Naha stream near the hatchery for the sculpins, or so-called "bullheads," which frequent the spawning grounds to feed on salmon eggs. The trap was baited with salmon eggs and the sculpins entered it readily. Forty thousand were taken during the season, 2,700 entering the trap during one night. The trap also took numbers of young trout. The destruction of such enemies of the salmon, which eat both eggs and fry, is obviously an important part of salmon-cultural work. At Fortmann hatchery, before fry are planted in the Naha, the stream is freed of trout by dynamiting the pools and places in which they lurk.

Output of the Salmon Hatcheries of Alaska 1906-7 and 1907-8.

Hatcheries.	1906-7.								1907-8.
	Sockeye.		Coho.		Steelhead trout.		Total.		Sockeye.
	Eggs taken.	Fry liberated.	Eggs taken.	Fry liberated.	Eggs taken.	Fry liberated.	Eggs taken.	Fry liberated.	Eggs taken.
Karluk	38,679,200	36,846,000					38,679,200	36,846,000	47,808,200
Fortmann	105,420,000	80,946,000	30,000	27,000			105,450,000	80,973,000	41,280,000
Yes Lake	58,210,000	54,610,800			182,000	143,500	58,392,000	54,754,300	65,550,000
Klawak	3,600,000	1,187,000					3,600,000	1,187,000	3,500,000
Callbreath [a]									
Hetta									8,000,000
Total	205,909,200	173,589,800	30,000	27,000	182,000	143,500	206,121,200	173,760,300	166,138,200

[a] Operated in 1906-7 but no report received; probably not operated in 1907-8.

SALMON-MARKING EXPERIMENTS.

Salmon-marking experiments, though open to various objections and apt to be inconclusive, nevertheless are one of the few practicable methods of studying the difficult problems of age and migrations of the salmon, and are capable of being made to furnish useful information. They involve a great deal of work, for it is necessary to examine large numbers of salmon at various localities each season to

get the maximum value of the marking. It is probable, however, that the use of a thermocautery in removing certain fins will make possible the marking of fry soon after the absorption of the sac, if not earlier, and will increase the speed and facility of the process. Experiments already made indicate that this is a practical method of marking. The Bureau of Fisheries intends to continue these experiments in Alaska; and it is hoped that hatchery authorities or others will make no identification marks on salmon without consultation with the Bureau, in order to avoid confusion through adoption of the same or similar marks.

Regeneration of fins after cuts or injuries of course seriously affects the value of marking experiments based on the cutting or removal of fins. It is known that with some salmonoids, as brook trout, cutting away a portion of some of the fins may be followed by a quite complete regeneration. This has not been observed with the adipose. With the Pacific salmons the evidence at present tends to show that injuries and excisions of parts of the fins do not result in regeneration to any marked degree, and especially a fin which is removed by cutting deeply to its base will not renew itself at all.

Return of salmon marked at Fortmann hatchery.—In August, 1903, 1,600 red salmon fry hatched at Fortmann hatchery were marked at the age of about three months, by Mr. F. M. Chamberlain, of the Bureau of Fisheries, and released in the Naha above Heckman Lake. The mark consisted in the complete removal of both ventral fins by means of small scissors. No adult redfish lacking the ventrals were taken at Fortmann hatchery until the fall of 1906, and then but two specimens. From 50 to 100 of such fish, however, were reported by the superintendent of Yes Lake hatchery in the spawning run of 1906 at Yes Lake. In 1907 no redfish lacking both ventrals were seen at Yes Lake hatchery, but about a dozen were taken having but a single ventral. At Fortmann hatchery the spawning run of 1907 yielded 13 redfish with both ventrals gone, and 1 with a single ventral.

Specimens of the adult salmon lacking both ventrals were seen and examined at Fortmann hatchery by the salmon agent. In most cases there was scarcely a trace of the position of the missing fins, the skin at the site of the base of this pair of fins being overgrown with scales which indicated the former position of the fins only by their somewhat enlarged size and irregularity of arrangement. In one case very short irregularly shaped stubs remained. The completeness of the removal of these fins and the obliteration with the growth of the fish of all but faint traces of the former existence of a pair of ventral fins is somewhat remarkable. The identity, however, of these adult salmon lacking ventrals with the individuals above referred to, marked as fry in 1903 by the excision of these fins, is very nearly conclusive, considering the infrequency of the absence of ventral fins

from natural causes. Mr. Chamberlain[a] found but one case among many thousands of redfish examined prior to 1906. During the summer of 1907 an examination of 2,672 redfish from southeast Alaska, most of them taken south of Ketchikan, revealed none lacking either ventral fin. Of 5,950 humpback salmon from the same general region, one left ventral was entirely lacking, but in no case was the pair absent. The ventral fins are, moreover, seldom mutilated. The most frequent abnormality is asymmetry of size in the pair, one fin being dwarfed, but otherwise usually perfect. This examination will be continued until data are obtained upon a large number of salmon.

Considering only the marked salmon coming back to the Naha, the return is nearly 1 per cent on fry liberated at the age of about 3 months. Most of these returned in 1907, and indicate $4\frac{1}{2}$ years as the approximate age of the redfish from the time of hatching to sexual maturity. That all individuals of a given hatching do not mature in the same year is not improbable, and is indicated by the return of the Naha marked fish at Yes Lake in 1906. The same evidence also indicates that while a part of a given hatch of salmon may return to the parent stream a greater part may go to other streams of the region.

Experiments at Klawak.—Mr. H. F. Swift, superintendent of the Klawak cannery, reports three experiments in marking salmon at the Klawak hatchery. A period of one or two years intervened between the markings. The mark consisted in the removal of the adipose fin from redfish fingerlings taken from Klawak Lake, at a presumed age of about $1\frac{1}{2}$ years. In the first experiment about 1,000 fish were marked, in the other two about 2,000 each. A return of about 20 per cent is claimed in each of the first two cases, and about 5 per cent in the third, the return in every case occurring the third year after the marking. The fingerlings marked must have been in part, presumably much the smaller part, the product of natural spawning.

HATCHERY REBATES.

The August grand jury of the third judicial district, sitting at Valdez, in its final report strongly urged that the provision of the Alaska fisheries law exempting owners of private salmon hatcheries "from all license fees and taxation of every nature at the rate of 10 cases of canned salmon to every 1,000 red or king salmon fry liberated," be repealed and that the canneries be compelled to pay the regular license tax of 4 cents per case of canned salmon, without rebate, as heretofore. While there is no doubt that the fund for the building of roads, etc., in Alaska has suffered somewhat from the exemptions granted by the new law, another side of the question deserves consideration. At the present time there are four hatcheries

[a] See "Some Observations on Salmon and Trout in Alaska." F. M. Chamberlain, Bureau of Fisheries, Document No. 627, p. 66–68.

operated by companies which can salmon, viz, at Karluk and on the Naha, by the Alaska Packers Association; at Klawak, by the North Pacific Trading and Packing Company, and at Hetta, by the Northwestern Fisheries Company. The Alaska Packers Association has been operating its two large hatcheries (the total expenditure on which, without counting in the cost of maintenance, has been something like $300,000) for some years. Up to last year, when the new law went into effect, the association had borne, in addition to the initial cost of these plants, and the large annual expense entailed in operating them, the regular license tax of 4 cents on every case packed, just as had those canneries which did not operate hatcheries. Under the present law the owners of private hatcheries receive in rebates probably a little less than the cost of operating, which is a much more equitable arrangement than that under the old law. During the period from July 1, 1906, to June 30, 1907, the three hatcheries which were then operated by private companies (the Northwestern Fisheries Company did not open the Hetta hatchery until after the close of the hatching season of 1906–7) deposited in the streams of Alaska 118,979,000 fry, for which they received rebate certificates to the value of about $47,590. The hatchery owner receiving these certificates is permitted to use them in the payment, or part payment, of his license tax on salmon packed.

LAWS AND VIOLATIONS.

FORTY-EIGHT-HOUR LAW.

Cannery men, with very few exceptions, vigorously approve the section of the law forbidding the canning of salmon which have been dead longer than forty-eight hours. The law makes no distinction between the species, however, whereas there is considerable difference in the rapidity with which different species of salmon, under the same conditions, become unfit to can. The softer tissues of the humpback become tainted sooner than those of the redfish, and in warm weather may not remain in proper condition for 48 hours; on the other hand, in cold weather the redfish may sometimes be comparatively firm and fresh when two days old. The law as it stands is certainly not too rigorous and imposes no hardships. Its observance should be demanded and is to the interests of all concerned.

WEEKLY CLOSE PERIOD.

The change in the weekly close period from Saturday to Sunday did not go into effect in 1906 until the season was somewhat advanced. The change occurred on June 26, 1906, but allowing some time for its promulgation, the new arrangement can not be said to have had a thorough trial until the season of 1907. Only a few expressed dissatisfaction with the change, while most cannery men and fishermen

either prefer Sunday or are indifferent to which day is selected for the close season. On the whole the change has been beneficial and should be allowed to stand.

CLOSING OF NUSHAGAK AND WOOD RIVERS.

The closing of Wood River to commercial fishing in order to increase the number of redfish reaching the important spawning beds at the headwaters of this stream has been frequently advocated and repeatedly recommended by the salmon agent. On October 28, 1907, the secretary of the Alaska Fishermen's Union of San Francisco requested, by a telegram to the Secretary of Commerce and Labor, a hearing as provided by law, to determine the advisability of closing Wood River completely to commercial fishing, and of prohibiting all stationary fishing gear in Nushagak River. Similar telegrams and requests were received from the secretary of the United Fishermen of the Pacific, of Seattle, Wash., from Senator C. W. Fulton, of Astoria, Oreg., and others. In accordance with these requests the following announcement was issued:

To all whom it may concern:

Whereas the Secretary of Commerce and Labor has been requested by numerous persons and organizations to prohibit all commercial fishing in Wood River, Alaska, and to forbid the setting of traps and stationary gear of any kind in Nushagak River, Alaska, notice is hereby given that under the provisions of section 6 of the act of Congress approved June 26, 1906, entitled "An act for the protection and regulation of the fisheries of Alaska," a hearing to determine the advisability of setting aside as preserves for spawning grounds Wood River and Nushagak River, Alaska, and of limiting or entirely prohibiting all fishing therein, will be held in the office of the Secretary of Commerce and Labor at Washington, D. C., on December 16, 1907, at 10 o'clock a. m., at which time all persons interested will be heard.

GEORGE M. BOWERS,
Commissioner of Fisheries.

Approved:
OSCAR S. STRAUS,
Secretary of Commerce and Labor.

This announcement was published in several newspapers on the Pacific coast and copies of it were sent by the Commissioner of Fisheries to all parties known to be interested. The hearing was held on December 16 and 17, 1907, before the Secretary of Commerce and Labor, and was attended by representatives of the Alaska Fishermen's Union, the United Fishermen of the Pacific, the Alaska Packers Association, of San Francisco; the Alaska-Portland Packers Association of Portland, Oreg; the Northwestern Fisheries Company of Seattle, Wash.: and the Columbia River Packers Association of Astoria, Oreg.; and by the Hon. C. W. Fulton, Senator from Oregon; the Hon. William R. Ellis, Congressman from Oregon; the Hon. Thomas Cale, Delegate from Alaska; the Hon. George M. Bowers, Commissioner of Fisheries, and other representatives of his Bureau.

In addition, a number of salmon packers expressed their views in letters, which were filed as a part of the evidence submitted.

As a result of this hearing the Secretary of Commerce and Labor issued, on December 19, 1907, the following order:

To whom it may concern:

A hearing having been given at the Department of Commerce and Labor, beginning December 16, 1907, at which all persons interested in the closing or nonclosing of Wood and Nushagak rivers, Alaska, for fishing purposes were fully heard, due notice of which was given according to law, by virtue of the authority vested in me by section 6 of "An act for the protection and regulation of the fisheries of Alaska," approved June 26, 1906, it is hereby ordered that until further notice Wood River, a tributary of Nushagak Bay, in the district of Alaska, and the region within 500 yards of the mouth of said Wood River be closed to all commercial fishing, and that all commercial fishing be prohibited in Nushagak River proper.

This order becomes effective January 1, 1908.

OSCAR S. STRAUS,
Secretary.

OFFENSES.

On July 25, 1907, a crew of 7 Japanese fishermen were seining salmon above the mouth of Ketchikan creek, violating section 4 of the fisheries law, which forbids laying nets across or above the tide waters of a creek for a distance greater than one-third the width of the creek. This crew completely closed the stream with their seine and with their oars drove the fish from above into the net and then made the haul. The facts were reported and information filed with the assistant United States district attorney at Ketchikan. The fishermen were apprehended, and, on examination by the United States court commissioner, were committed and given opportunity to secure counsel. On July 29 they were arraigned and by advice of counsel refused to plead. After the hearing, 6 of them were bound over to the fall term of the grand jury and released on bail. The seventh was discharged, the identification being unsatisfactory.

The grand jury returned an indictment October 19. On arraignment the foreman pleaded guilty, whereupon the cases against his companions were dismissed. A fine of $100 was imposed and paid.

On August 1, 1907, a crew of 6 white fishermen at Ketchikan committed substantially the same offense as that described above. Information was filed August 6 and some of the offenders were arrested, but at the request of the salmon agent the cases against all but the foreman were dismissed. The latter was arraigned by the United States court commissioner August 16, pleaded guilty, was bound over to the grand jury and released on his own recognizance. October 19 he was indicted by the grand jury, pleaded guilty before the district court, and paid a fine of $300.

An information was filed at Ketchikan October 8 by the salmon agent against a native fisherman, foreman of a fishing crew, for violation of the weekly close season. The act was committed near Dolomi

on August 5, 1907, and consisted in fishing in the early hours of Monday morning before 6 o'clock, a considerable catch of red and humpback salmon having been made. Complaint was made to the salmon agent by other fishermen whose prospects were prejudiced by the illegal fishing, since they would have properly shared in the salmon run after 6 o'clock. This case was taken directly to the grand jury, which returned an indictment October 19. The accused was arraigned October 28, pleaded guilty, and was fined $50. The fine was paid.

A claim was presented at Juneau May 16 by a Kake Indian, who stated that his exclusive fishing rights in certain streams in the region of Pillar Bay had been encroached upon. Such alleged Indian rights, which are continually being contended for, are not recognized by law, and accordingly no action was taken in this case further than investigation to determine whether any of the reported fishing was in fact illegal. No proof was obtained, and the native policeman in the locality reported that he had received no complaints.

CATCH OF SALMON.

Below will be found a table showing, for the geographic sections, by apparatus and species and by species alone, the catch of salmon for the years 1906 and 1907.

The noticeable feature of this table is the increase in the number of salmon taken by seines and traps and the decrease in the gill-net catch. The increase in the seine catch consists almost wholly of humpbacks. Red and humpback salmon comprise the bulk of the increase in the trap catch, while dog salmon show a large decrease. The decrease in the gill-net catch is due mainly to a falling off in the number of red and dog salmon taken. All of the seine increase occurred in southeast Alaska, where there was a very good run of humpbacks. Both southeast and central Alaska show increases in trap-net catch, due in the former to an increased number of humpback and in the latter to an increase in the number of red salmon secured. The trap-net catch of western Alaska shows a decrease, mainly in dog and humpback salmon, although the red salmon thus caught show an increase. All three sections show a decrease in the catch by gill nets. The line catch also shows a material decrease.

The table shows also a large increase (4,960,723 fish) in the catch of humpback salmon, a considerable decrease in the catch of dog salmon, and a small decrease in the catch of coho salmon. Despite the poor run in the Nushagak, the net red salmon decrease was only 369,651 fish. Southeast and central Alaska show aggregate increases, while western Alaska shows a decrease. In southeast Alaska the increase is mainly in humpback salmon, and in central Alaska in red and humpback. The principal decreases in western Alaska are in dog and red salmon, due almost wholly to the very light run in the Nushagak.

Catch of Salmon in Alaska in 1906 and 1907, Shown by Species and Apparatus.

Apparatus and species.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	1906.	1907.	1906.	1907.	1906.	1907.	1906.	1907.
Seines:								
Coho, or silver	309,154	302,963	23,738	48,759			322,892	351,722
Dog, or chum	1,157,139	1,101,822					1,157,139	1,101,822
Humpback, or pink	5,722,877	8,614,551		252,373			5,722,877	8,866,924
King, or spring	1,122	259	3,640	4,015			4,762	4,274
Sockeye, or red	1,502,389	1,419,221	4,068,582	3,568,069			5,570,971	4,987,290
Total	8,692,681	11,438,816	4,095,960	3,873,216			12,788,641	15,312,032
Traps:								
Coho, or silver	256,708	139,783	93,485	163,076	1,500	29,199	351,693	332,058
Dog, or chum	355,048	158,170			466,632	36,141	821,680	194,311
Humpback, or pink	1,377,439	3,438,335	64,100	6,420	352,526	1,500	1,794,065	3,446,255
King, or spring	4,335	26,835	16,858	36,791	6,530	5,011	27,723	68,637
Sockeye, or red	615,261	615,684	1,487,606	2,711,142	791,166	1,078,869	2,894,033	4,405,695
Total	2,608,791	4,378,807	1,662,049	2,917,429	1,618,354	1,150,720	5,889,194	8,446,956
Gill nets:								
Coho, or silver	91,609	83,943		15,000	206,110	109,650	297,719	208,593
Dog, or chum	58,522	74,298			1,222,043	472,586	1,280,565	546,884
Humpback, or pink	99,496	18,029			91,561	337,514	191,057	355,543
King, or spring	30,956	70,388	7,869	27,022	138,343	134,391	177,168	231,801
Sockeye, or red	353,383	214,442	441,491	358,649	10,224,060	9,181,034	11,018,934	9,754,125
Total	633,966	461,100	449,360	400,671	11,882,117	10,235,175	12,965,443	11,096,946
Lines:								
Coho, or silver	2,500	1,052					2,500	1,052
King, or spring	58,174	23,082					58,174	23,082
Total	60,674	24,134					60,674	24,134
Spears:								
Sockeye, or red	52,823	20,000					52,823	20,000
Total:								
Coho, or silver	659,971	527,741	117,223	226,835	207,610	138,849	984,804	893,425
Dog, or chum	1,570,709	1,334,290			1,688,675	508,727	3,259,384	1,843,017
Humpback, or pink	7,199,812	12,070,915	64,100	258,793	444,087	339,014	7,707,999	12,668,722
King, or spring	94,587	120,564	28,367	67,828	144,873	139,402	267,827	327,794
Sockeye, or red	2,523,856	2,269,347	5,997,679	6,637,860	11,015,226	10,259,903	19,536,761	19,167,110
Grand total	12,048,935	16,322,857	6,207,369	7,191,316	13,500,471	11,385,895	31,756,775	34,900,068

CANNING.

When the year 1907 opened there were probably 300,000 cases of the previous year's Alaska red salmon in the hands of the canners unsold. For several months the demand was light, but in April the transcontinental railroads put into effect a reduced rate to eastern points which very speedily resulted in the selling and shipment of these cases. The demand from abroad also began to improve about this time, and when the fishing season opened there were practically no canned red salmon in the hands of the packers. The pack of other species of Alaska salmon had practically all been sold out by the first of the year. The opening prices on this year's pack were fixed from 5 to 35 cents per dozen cans higher than prevailed in 1906, and despite this the demand was so great that practically all the red salmon canned were sold before the pack was completed, while of

the other grades but few remained in the hands of the canners at the end of the year, and these will undoubtedly be sold long before the season of 1908 opens.

The pack of red salmon this year was the smallest for several years, but the pack of humpbacks increased very materially. The consumption of the latter has increased enormously in recent years. For a time the pack was nearly all sold in this country, but the export demand is rapidly increasing, and it is very probable that humpback salmon will soon become an important feature in the market.

Employees.—The fishermen engaged this year numbered 3,325, of whom more than two-thirds were white. The cannery employees numbered 6,809, among whom the Chinese were the most numerous, followed by the Japanese, whites, and Indians in the order named. The transporters numbered 515, of whom 482 were whites and 33 Indians. In all, 10,649 persons (4,110 whites, 2,466 Indians, 1,863 Japanese, and 2,205 Chinese) were employed in the salmon-canning industry.

EMPLOYEES IN THE SALMON-CANNING INDUSTRY IN 1907.

Occupation and race.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	364	382	1,462	2,208
Indians	1,010	78	8	1,096
Japanese	21			21
Total	1,395	460	1,470	3,325
Shoresmen:				
Whites	353	179	897	1,429
Indians	936	96	301	1,333
Chinese	726	471	1,008	2,205
Japanese	301	268	1,273	1,842
Total	2,316	1,014	3,479	6,809
Transporters:				
Whites	191	146	145	482
Indians	33			33
Total	224	146	145	515
Grand total	3,935	1,620	5,094	10,649

Investment.—There were 120 steamers and launches and 36 sailing vessels engaged in transporting. Of these, one power vessel, the gasoline schooner *Rita Newman,* was wrecked on Simeonof Island May 25; the sailing ship *John Currier* was wrecked at Nelson Lagoon, in Bering Sea, on August 9, and the sailing ship *Servia*, while at Karluk, broke loose from her moorings and was driven ashore and totally wrecked on November 6. Most of the sailing vessels are utilized in western Alaska for the purpose of bringing up the outfit and employees in the spring and carrying home the employees and pack after the season closes, as no established steamship lines plying to

that section are capable of handling this enormous business. The vessels remain at anchor in the vicinity of their respective canneries throughout the season.

Gill nets were the most numerous kind of apparatus used, the greater part being employed in western Alaska. Purse seines were employed exclusively in southeast Alaska, while haul seines were operated only in southeast and central Alaska. The number of traps operated was 70, an increase of 10 over 1906. Southeast Alaska increased its number from 29 in 1906 to 40; and central Alaska, from 13 in 1906 to 15, but in western Alaska the number decreased from 18 to 15. A new form of floating trap was operated at several places this year. The total investment was $8,419,930.

There were 48 canneries in operation (22 in southeast Alaska, 8 in central Alaska, and 18 in western Alaska). In southeast Alaska the Hunter Bay and Quadra canneries of the Northwestern Fisheries Company, which had been closed for several years, were reopened. In western Alaska the Bradford cannery of the Alaska Packers Association, located on Nushagak Bay, and the Williams cannery of the same association, on the Ugashik River, and the cannery of the Union Packing Company, on the Kvichak River, were closed, while the reserve cannery of the Alaska Packers Association, on the Ugaguk River, was reopened, and a new cannery was built and operated by Mr. L. A. Pedersen near the mouth of Kvichak Bay.

VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED IN THE SALMON-CANNING INDUSTRY IN 1907.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Canneries	22		8		18		48	
Transporting vessels:								
Steamers and launches	57	$357,600	23	$238,000	40	$526,802	120	$1,122,402
Tonnage	1,387		1,205		2,268		4,860	
Sailing	4	174,500	8	235,000	24	559,500	36	969,000
Tonnage	6,608		12,134		33,007		51,749	
Boats	644	94,680	320	62,333	852	278,080	1,816	435,093
Apparatus:								
Haul seines	65	16,150	37	15,405			a 102	31,555
Purse seines	111	41,239					b 111	41,239
Gill nets	132	24,820	44	8,100	769	58,203	c 945	91,123
Traps	40	116,650	15	24,550	15	21,500	70	162,700
Spears	200	150					200	150
Shore and accessory property		1,836,357		1,209,968		2,520,343		5,566,668
Total		2,662,146		1,793,356		3,964,428		8,419,930

a Aggregate length of 46,100 yards. b Aggregate length of 39,510 yards. c Aggregate length of 226,000 yards.

Output.—The table of products shows, with size and style of can, the quantity and value of each species packed. Southeast Alaska leads in the total quantity packed, but is second to western Alaska

in the total value of pack. Sockeye, or red, salmon occupies first place in the output, slightly over half of this coming from western Alaska. Humpbacks are second in quantity and value. Quite a little attention was paid this year to the packing of humpback salmon in flat cans, the fish cutting out better in this size of can than in the "talls." A few hundred cases of dog salmon were packed in flat cans; partly because of the scarcity of tall cans late in the season, and the consequent necessity of using the flat cans or not packing at all. Of the total pack given below the following were lost in the various disasters mentioned elsewhere in this report: Dog, or chum, 8,279 cases; humpback, or pink, 4,000 cases; king, or spring, 3,713 cases; and sockeye, or red, 57,855 cases. These have been included in the statistical tables, as they had passed through all the stages of packing and were eventually paid for by the insurance companies.

TABLE SHOWING, BY SPECIES AND SIZES OF CANS, THE OUTPUT OF SALMON FROM THE CANNERIES IN 1907.[a]

Products.	Southest Alaska.		Central Alaska.		Western Alaska.		Total.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
Coho, or silver:								
½-pound flat	969	$4,273					969	$4,273
1-pound flat	3,933	17,292					3,933	17,292
1-pound tall	53,730	212,239	15,258	$57,980	11,784	$45,600	80,772	315,819
Total	58,632	233,804	15,258	57,980	11,784	45,600	85,674	337,384
Dog, or chum:								
½-pound flat	491	1,228					491	1,228
1-pound flat	664	2,125					664	2,125
1-pound tall	139,237	404,016			44,025	140,388	183,262	544,404
Total	140,392	407,369			44,025	140,388	184,417	547,757
Humpback, or pink:								
½-pound flat	17,589	46,093					17,589	46,093
1-pound flat	7,406	26,662					7,406	26,662
1-pound tall	517,273	1,635,686	10,255	32,458	18,244	58,381	545,772	1,726,525
Total	542,268	1,708,441	10,255	32,458	18,244	58,381	570,767	1,799,280
King, or spring:								
½-pound flat	28	98					28	98
1-pound tall	1,261	5,255	14,355	60,291	27,794	116,074	43,410	181,620
Total	1,289	5,353	14,355	60,291	27,794	116,074	43,438	181,718
Sockeye, or red:								
½-pound flat	45,383	160,731					45,383	160,731
1-pound flat	29,821	154,646					29,821	154,646
1-pound tall	101,945	463,888	482,968	2,191,994	657,687	2,943,968	1,242,600	5,599,850
Total	177,149	779,265	482,968	2,191,994	657,687	2,943,968	1,317,804	5,915,227
Grand total	919,730	3,134,232	522,836	2,342.723	759,534	3,304,411	2,202,100	8,781,366

[a] All pound cases contain 48 one-pound cans; the half-pound cases contain 48 half-pound cans.

Comparison of pack of 1905, 1906, and 1907.—Of the three years in question the pack of 1906 exceeds the other two in quantity, but in total value the pack of 1907 is in the lead. The increase in the pack of humpbacks is very noticeable; in 1905 there were packed of

these 168,597 cases; in 1906, 349,767 cases, and in 1907, 570,767, an increase for 1907 over 1905 of 402,170 cases. The pack of red salmon was largest in 1905 (1,587,343 cases); this year it was 269,539 cases less. While the pack of dog salmon was larger in 1907 than in 1905, it was considerably less than in 1906, and the same is true of the pack of cohos.

Taking the "1-pound tall," which is the common size can, as a basis of comparison, it is seen that there has been a uniform increase in price each year over the preceding year. In 1905 cohos averaged \$3.20 per case; in 1906, \$3.63 per case, and in 1907, \$3.91 per case. Dog, or chum, salmon averaged \$2.69 per case in 1905, \$2.87 per case in 1906, and \$2.97 per case in 1907. Humpback, or pink, salmon averaged \$2.95 per case in 1905, \$3 per case in 1906, and \$3.16 per case in 1907. King salmon averaged \$3.28 per case in 1905, \$3.78 in 1906, and \$4.18 per case in 1907. Sockeye, or red, salmon averaged \$3.38 per case in 1905, \$3.77 per case in 1906, and \$4.59 per case in 1907.

COMPARISON OF THE OUTPUT OF THE SALMON CANNERIES IN 1905, 1906, AND 1907.

Products.	1905.		1906.		1907.	
	Number of cases.	Value.	Number of cases.	Value.	Number of cases.	Value.
Coho, or silver:						
½-pound flat	1,032	\$1,754	3,217	\$6,588	969	\$4,273
1-pound flat	394	1,340	15,944	63,487	3,933	17,292
1-pound tall	66,484	212,781	91,582	312,034	80,772	315,819
Total	67,910	215,875	110,743	382,109	85,674	337,384
Dog, or chum:						
½-pound flat	....	....	....	....	491	1,228
1-pound flat	....	....	....	....	664	2,125
1-pound tall	41,972	113,056	254,812	730,235	183,262	544,404
Total	41,972	113,056	254,812	730,235	184,417	547,757
Humpback, or pink:						
½-pound flat	....	....	2,940	4,851	17,589	46,093
1-pound flat	....	....	2,618	8,378	7,406	26,662
1-pound tall	168,597	498,194	344,209	1,033,722	545,772	1,726,525
Total	168,597	498,194	349,767	1,046,951	570,767	1,799,280
King, or spring:						
½-pound flat	....	....	189	397	28	98
1-pound flat	4,248	17,585	....	....	....	....
1 pound tall	37,877	124,414	30,748	115,825	43,410	181,620
Total	42,125	141,999	30,937	116,222	43,438	181,718
Sockeye, or red:						
½-pound flat	25,830	46,674	49,541	125,395	45,383	160,731
1-pound flat	18,725	67,410	36,763	161,793	29,821	154,646
1-pound tall	1,542,788	5,221,463	1,414,426	5,333,687	1,242,600	5,599,850
Total	1,587,343	5,335,547	1,500,730	5,620,875	1,317,804	5,915,227
Grand total	1,907,967	6,304,671	2,246,989	7,896,392	2,202,100	8,781,366

The Pacific coast pack of canned salmon.—The table below shows by species and regions the number of cases of salmon packed on the Pacific coast in 1907. The pack has been reduced to a common basis of cases containing 48 1-pound cans.

THE PACIFIC COAST SALMON PACK.

Place.	Coho, or silver-side.	Dog, or chum.	Hump-back, or pink.	Chinook, king, or spring.	Sockeye, blue-back, or red.	Steel-head trout.	Total.
	Cases.	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*
Alaska	85,189	184,172	561,972	43,434	1,295,112	....	2,169,879
British Columbia:							
Fraser River	31,447	16,421	43,095	3,487	35,563	....	130,013
Other rivers	51,662	18,657	36,391	32,510	191,622	683	331,525
Puget Sound	95,375	51,780	439,652	5,663	71,587	....	664,057
Columbia River	27,851	22,556	....	204,549	5,504	4,866	265,326
Oregon and Washington coasts	96,165	29,249	....	11,677	....	....	137,091
Total	387,689	322,835	1,081,110	301,320	1,599,388	5,549	3,697,891

PICKLING.

The salmon salteries again had an excellent season. The fish were in fair abundance, while the prices realized for the pack were somewhat better than in 1906, which was the first profitable season the salteries had had in five years.

The United States Bureau of Education expects to send an experienced salter to its station on Kotzebue Sound next year (1908) in order to instruct the natives in the best and latest methods of pickling salmon, the intention being to market the surplus pack on Puget Sound. As this region has never been exploited commercially, the result will be awaited with interest.

Employees.—This year 483 persons (of whom 265 were fishermen, 186 shoresmen, and 32 transporters), an increase of 121 over 1906, were engaged in the pickling industry, over one-half of them employed in southeast Alaska.

EMPLOYEES IN THE SALMON PICKLING INDUSTRY IN 1907.

How engaged.	South-east Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	88	7	49	144
Indians	43	68	10	121
Total	131	75	59	265
Shoresmen:				
Whites	74	5	46	125
Indians	58	1	....	59
Japanese	2	....	....	2
Total	134	6	46	186
Transporters:				
Whites	20	....	10	30
Indians	....	2	....	2
Total	20	2	10	32
Grand total	285	83	115	483

Investment.—There were 24 salteries (18 in southeast Alaska and 3 each in central and western Alaska), an increase of 4 over 1906. In addition, some of the canneries, and several of the mild-curing plants, also salted their surplus catch, and while the product has been included in the present figures the men and investment could not be separated from the statistics of the other branches of the industry. In western Alaska the saltery of Mr. L. A. Pedersen was turned into a cannery. The total investment in the pickled-salmon industry amounted to $309,313, a slight gain over 1906.

VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED IN THE SALMON PICKLING INDUSTRY IN 1907.

Item.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Salteries	18		3		3		24	
Transporting vessels:								
Steamers and launches	12	$26,400			2	$5,750	14	$32,150
Tonnage	190				10		200	
Sailing	2	8,800	1	$450	2	28,000	5	37,250
Tonnage	1,198		13		639		1,850	
Boats	91	11,678	27	840	35	6,345	153	18,863
Apparatus:								
Haul seines	15	2,015	14	965			[a] 29	2,980
Purse seines	8	2,830					[b] 8	2,830
Gill nets	9	1,040			26	1,400	[c] 35	2,440
Traps	3	3,200	2	1,000	3	1,380	8	5,580
Shore and accessory property		164,220		3,500		39,500		207,220
Total		220,183		6,755		82,375		309,313

[a] Had aggregate length of 4,940 yards. [b] Had aggregate length of 2,150 yards.
[c] Had aggregate length of 6,900 yards.

Output.—The pack amounted to 23,182 barrels and 4,180 half barrels, with a total value of $240,549. This is an increase of 6,256 barrels and 791 half barrels in quantity and $100,711 in value over 1906. Red salmon formed by far the greater part of this pack and most of these were put up in western Alaska. There is a large increase shown in the number of red and humpback bellies packed, while 191 barrels of coho bellies were put up (none of the latter were packed in 1906). The packing of salmon bellies is a very wasteful process, as all but the belly portion is thrown away, and to pack a barrel of bellies requires more than four times the number of salmon required for a barrel of whole fish. As the run of salmon is none too large to be handled by other and less wasteful methods even in the best of seasons, the use of fish in this wasteful manner should be absolutely prohibited. In the wreck of the bark *Servia* at Karluk, in November, 473 barrels of pickled salmon were lost. These, however, as in the case of the canned salmon, have been included in the statistical tables.

A considerable quantity of coho, dog, humpback, and red salmon was prepared at Juneau by splitting the fish down the back, removing the backbone and entrails, and then salting lightly in boxes holding

about 500 pounds of fish. These were shipped to Seattle, where they were packed in the regular pickled-salmon barrels. The fish so prepared, amounting to 162,736 pounds, valued at $5,415, have not been included in the table below, but appear in the general tables at the beginning of this report.

TABLE SHOWING, BY SPECIES, THE QUANTITY OF SALMON PICKLED IN 1907.

Products.	Unit of quantity.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
		Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Coho, or silver	Barrels	931	$9,066	671	$6,710	63	$630	1,665	$16,406
Coho bellies	Barrels			191	2,696			191	2,696
Dog, or chum	Barrels	205	1,325			28	196	233	1,521
Humpback, or pink	Half barrels	417	2,175			1	4	418	2,179
	Barrels	4,013	26,987			26	208	4,039	27,195
Total			29,162				212		29,374
Humpback bellies	Half barrels	901	5,553					901	5,553
	Barrels	1,350	15,527					1,350	15,527
Total			21,080						21,080
King, or spring	Half barrels					1	5	1	5
	Barrels	14	248	172	2,580	777	7,851	963	10,679
Total			248		2,580		7,856		10,684
King bellies	Half barrels					5	30	5	30
	Barrels			29	348	52	624	81	972
Total					348		654		1,002
Sockeye, or red	Half barrels			150	900	2,705	12,850	2,855	13,750
	Barrels	339	3,243	1,842	19,062	11,589	109,087	13,770	131,392
Total			3,243		19,962		121,937		145,142
Sockeye bellies	Barrels			890	12,644			890	12,644
Grand total	Half barrels	1,318		150		2,712		4,180	
	Barrels	6,852	64,124	3,795	44,940	12,535	131,485	23,182	240,549

MILD CURING.

The mild curing of salmon is rapidly becoming an important industry. The season of 1906 was the first in which it was conducted on a large scale, and it proved profitable to all persons concerned. Only the larger king salmon were used in 1906. This year the demand for the product was so great that kings as small as 14 pounds were accepted. One dealer also packed a quantity of coho, dog, and humpback salmon, all of which was put up in barrels holding 400 pounds.

Employees.—There were 330 persons (of whom 208 were fishermen, 102 shoresmen, and 20 transporters) employed in the industry in 1907, against 177 in 1906. The greater part of these were employed in southeast Alaska.

EMPLOYEES IN THE SALMON MILD-CURING INDUSTRY IN 1907.

Occupation and race.	Southeast Alaska.	Central Alaska.	Total.
Fishermen:			
Whites	58	20	78
Indians	130		130
Total	188	20	208
Shoresmen:			
Whites	35	6	41
Indians	21	40	61
Total	56	46	102
Transporters:			
Whites	13	7	20
Grand total	257	73	330

Investment and output.—There were 14 mild-curing plants (12 in southeast Alaska and 2 in central Alaska) in operation. The industry is new in the latter section, the San Juan Fishing and Packing Company sending a large outfit to Kenai, on Cook Inlet, while the firm of J. Lindenberger, Incorporated, had a man at Orca, to prepare the king salmon caught by the fishermen for the Orca cannery. The total investment in the industry was $104,145.

The output amounted to 1,596 tierces (containing about 800 pounds each), all of king salmon, and 243 barrels (containing 400 pounds each) of coho, dog, and humpback salmon. The value of the total pack amounted to $106,334. The pack of 1906 amounted to 1,103 tierces of king salmon, valued at $65,747.

VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED, AND THE PRODUCTS PREPARED, IN THE SALMON MILD-CURING INDUSTRY IN 1907.

APPARATUS, ETC., EMPLOYED.

Items.	Southeast Alaska.		Central Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
Establishments	12		2		14	
Transporting vessels:						
Steamers and launches	7	$26,000	1	$3,200	8	$29,200
Tonnage	58		11		69	
Sailing			1	4,200	1	4,200
Tonnage			338		338	
Boats	139	15,540	18	4,100	157	19,640
Apparatus:						
Gill nets	205	27,750	20	800	225	28,550
Lines		255				255
Shore and accessory property		12,300		10,000		22,300
Total		81,845		22,300		104,145

PRODUCTS PREPARED.

	Unit of quantity.	Number.	Value.	Number.	Value.	Number.	Value.
Coho salmon	Barrels	103	$1,751			103	$1,751
Dog salmon	Barrels	60	500			60	500
	Tierces	10	110			10	110
Humpback salmon	Barrels	80	960			80	960
King salmon	Tierces	1,386	88,763	200	14,250	1,586	103,013
Grand total	Barrels	243				243	
	Tierces	1,396	92,084	200	14,250	1,596	106,334

DRY SALTING, SMOKING, FREEZING, ETC.

Dry salting.—The quantity of salmon, chiefly dogs, prepared in this manner has been falling off very rapidly since the close of the Russia-Japan war, as the Japanese, who were the chief buyers, are now able to secure nearly all they desire from the island of Sakhalin and the Amur River, in Siberia. The increased Japanese tariff on dry-salted fish, which has become effective since the war, has also proved a serious deterrent to exports from this country. The production of dry-salted dog salmon reached its height in 1905, when 7,280,234 pounds, valued at $115,643, was prepared. The pack in 1906 amounted to 1,107,680 pounds, valued at $16,969, and this year the pack still further declined to 107,580 pounds, valued at $1,505. Fortunately the rapidly expanding market for canned dog salmon has more than made up for the decreased demand for the dry-salted product.

Smoking.—As in 1906, but one establishment, the Juneau Packing Company, of Juneau, is equipped for smoking on a large scale, and this year the company prepared 53,629 pounds of smoked dog salmon, valued at $1,042. The same company also smokes other fish at this plant, particularly herring.

A considerable quantity of delicious smoked product, known locally as "bilik," is put up each season at Kodiak, red or silver salmon being used. Steelhead trout are the finest for this style of smoking, as they will remain good for a longer time than the salmon, but they are very scarce in the vicinity of Kodiak. There is a good outside demand for this product by those who have tried it, but as only a small quantity is prepared each season, and it is a favorite with the residents, there is but little surplus to ship away. An excellent trade could be built up if the necessary capital were devoted to the enterprise. The fish, when smoked, sell for from 15 to 20 cents a pair. About 20,000 pounds, valued at $500, were sold this year.

Freezing.—The only establishment at present engaged in freezing salmon is at Taku Harbor. The quantity prepared each season is small, this year being only 55,367 pounds, valued at $5,130. No king salmon were frozen, the output consisting of red, coho, and dog salmon.

Fresh salmon.—It is only since the winter of 1905 that the marketing of fresh salmon has attained any prominence. In January of that year the unusual abundance of king salmon attracted the attention of certain Ketchikan dealers, who began buying and shipping the fish to Puget Sound ports. The run lasted until May 18 and during that time 271,644 pounds, valued at $15,600, were shipped. The enterprise was conducted on a much wider scale in 1906, buyers being stationed at Ketchikan, Wrangell Narrows, Juneau, and Douglas, and the output amounted to 575,802 pounds of king salmon, valued at $29,584. In

1907, however, the excessively cold weather prevented fishing during January and February; and after the middle of the season the competition of the mild-curing plants proved too strong for the fresh-salmon buyers, who ceased operations for the year. A considerable quantity of other species besides king salmon were sold fresh this year. Of kings there was 403,031 pounds, valued at $17,402, of other species 135,099 pounds, valued at $6,865.

THE COD FISHERY.

All of the firms and individuals operating in the district for cod exclusively have their headquarters at San Francisco, Cal., or Seattle, Anacortes, or Tacoma, Wash., at which places, or in their immediate vicinity, the kench-cured fish are received and prepared for marketing. Nearly all of the operators have shore stations located at favorable places in central Alaska, from whence the dory fishermen carry on their fishery operations, bringing in their catch daily, and when sufficient kench-cured fish have accumulated to form a cargo, a vessel is dispatched from the home port, or else a fishing vessel completes its fare from the station catch, and carries the fish to the curing establishments on the coast. A small fleet of vessels also visits the banks, mainly in Bering Sea, where safe harbors in which shore stations can be established are very few.

There are a few small banks in southeast Alaska, but the fish caught there are rather small as compared with the central Alaska fish, examples more than 24 inches in length being rare. The banks, which vary from 5 to 7 fathoms in depth, are mainly in Chatham Straits and Lynn Canal. The fish are found on the banks in the summer, disappearing into the deeper water in the fall. They are said to spawn in the spring. In fishing, hand lines are used and the few fish taken are pickled.

In 1906 the cod industry was in a very demoralized condition, owing to a bitter price-cutting war between certain of the San Francisco dealers. At the opening of the present season prices had advanced slightly, although quite large stocks were on hand. The ruinous war of the previous year had had its effect, however, and the dealers now began to follow a safer and saner course, which soon resulted in the surplus being disposed of at fairly profitable prices. As the demand was good throughout the year, while the catch was less than anticipated, the greater part of the product was disposed of before the end of the year, and conditions were excellent at the beginning of 1908.

This industry has suffered from the spreading broadcast of exaggerated ideas as to its possible profits. As a result of this, persons totally unfamiliar with the work have engaged in it, and instead of building up a trade by the preparation of a good product at a living

price, have prepared goods in a slipshod manner and then disposed of them by cutting below the prices of the more reputable dealers. Such demoralization has given the Pacific coast product a bad name in the markets of the world.

A considerable part of the output is sold in the West Indies, but does not command as good a price as the Atlantic cod, owing to the fact that heretofore the fish have not been cured dry enough to stand the extreme heat of that region. A special effort is now being made to cater to this trade, however, and doubtless the Pacific product will soon be on a parity with its Atlantic competitor. An inferior grade of salt is used by some curers, and as fish in these cases show excessive traces of alkali, certain eastern shipments have either been rejected entirely or had to be sold at a sacrifice.

Ultimately the chief and most profitable market for Pacific cod will be the Pacific coast and the great Middle West, where the people are gradually being instructed in the use of cured fish, a slow process, however, in a section where meat has heretofore held practically unopposed sway. The dealers are now putting up the fish in small and handsome packages which prove very attractive to the consumer.

It is estimated that the fish caught by the vessels in 1907 averaged $5\frac{1}{3}$ pounds each, while those caught by the boat fishermen averaged $4\frac{1}{2}$ pounds each. The weight seems to vary in the different seasons, one company operating from Unga reporting that its winter-caught fish when salted run about 3,800 pounds to the 1,000, while in the summer the average is 4,000 pounds to the 1,000.

In winter some of the cod, in the neighborhood of Unga at least, become more or less diseased. It is reported that the flesh has dark red spots and sometimes spots of the same color appear on the skin. This year very few fish were found with scabs. In some parts of Alaska, cod are found with so-called lice (a lernean crustacean) upon them; fish so afflicted are usually caught in shallow water. The lice do not affect the flesh of the fish, as they are on the outside and can be easily brushed off, and but few are found on cod caught in the neighborhood of the stations.

Reports from British Columbia are to the effect that two of the pelagic sealing fleets which operated in Bering Sea made considerable catches of cod this summer by fishing on off days from the sides of the vessels. A deep-sea fishing company to operate in Bering Sea has been organized at Victoria, and it is reported several vessels will be sent out next year.

Cod are reported as abundant in the neighborhood of St. Lawrence Island, and it is the purpose of the United States Bureau of Education to send an experienced salter to its station on this island in 1908 for the purpose of instructing the natives in the best methods of curing them, the intention being to ship the surplus, if any, to Puget Sound ports for sale.

SHORE STATIONS.

During 1907 the following shore stations were in operation: Alaska Codfish Company—Company Harbor and Moffat Cove, Sannak Island; Unga, Baralof (Squaw Harbor), and Kelley Rock (Winchester), Unga Island, and Dora Harbor, on Unimak Island. Blom Codfish Company—Eagle Harbor on Nagai Island. Pacific-States Trading Company—Northwest Harbor, Little Koniuji Island, and Ikatik, on Unimak Island. Seattle-Alaska Fish Company—Baralof (Squaw Harbor), on Unga Island. Union Fish Company—Pirate Cove, Popof Island; Northwest Harbor, Little Koniuji Island; Eagle Harbor and Sanborn Harbor, on Nagai Island; Unga, on Unga Island; Pavlof Harbor and Johnson Harbor, on Sannak Island, and Dora Harbor on Unimak Island. The latter company has abandoned its Wedge Cape (Nagai Island) station.

Mr. A. Grosvold, merchant, at Sand Point, Unga Island, also operated a small cod-fishing station here this year. This was formerly an important cod station.

The Blom Codfish Company and Pacific-States Trading Company expect to establish new stations in 1908.

Usually all the stations are open during the summer, but owing to the difficulty of securing fishermen some of them were closed down in that season. Since the San Francisco earthquake, labor for Alaska has been very scarce, the high wages paid in the city, together with the assurance of permanent work, proving too attractive to be resisted by the better class of workers. Another reason is that fish are not so abundant in summer as in winter, and as the fishermen are paid by count, they are unable to average as much in summer. Practically all of the stations were operated during the winter of 1906–7, and the same was the case in the winter of 1907–8.

The 1906–7 winter fishing was very disastrous, but few fish being secured at most of the stations. A good catch was made during the spring months, however. A determined effort is being made this winter to secure a good catch, large crews and heavy supplies having been sent to the stations from the home ports.

At the stations, which are generally located close to the banks, fishing is carried on in dories, which are operated by one man. Hand lines are employed almost exclusively and the fisherman goes out and returns to the station the same day. A heavy drawback in the fishery is the prevalence of bad weather throughout a considerable part of the year, which prevents all dory fishing.

The station fisherman is paid from $25 to $30 per 1,000 fish of 28 or more inches in length, and should he engage in splitting he receives $2.50 per 1,000 fish in addition. All fish below 28 inches in length

count 2 for 1. The station owner furnishes the men with boats, lodging, food, and fuel, the fisherman providing only the fishing gear. When not out in his dory the fisherman's time is his own.

STATISTICS.

The tables below show the condition of the industry in 1907; also the fluctuations in the catch during the years 1905, 1906, and 1907. The best catch was made in 1905, followed by 1907 and 1906 in the order named. The local fleet now includes two fishing vessels which make their headquarters in Alaska. A total of 298 men were employed in the industry, all in central Alaska, of whom 235 were fishermen, 53 shoresmen, and 10 transporters.

Investment in the Central Alaska Cod Fisheries in 1907.

Items.	Number.	Value.
Fishing vessels:		
Sailing	2	$11,000
Tonnage	129	
Transporting vessels:		
Launches	1	6,000
Tonnage	7	
Sailing	3	9,500
Tonnage	48	
Boats	238	9,365
Apparatus:		
Vessel fisheries, hand lines		400
Shore fisheries, hand lines		3,190
Stations, with accessory property	19	70,700
Total		110,155

Products of the Central Alaska Cod Fisheries in 1907.

Products.	Round weight.	Salted weight.	Value.
	Pounds.	*Pounds.*	
Cod, salted	6,005,328	4,503,996	$146,209
Cod, pickled	1,466	1,100	43
Cod tongues, salted		1,300	120
Total	[a] 6,006,794	4,506,396	146,372

[a] Represents 1,050,329 fish.

Products of the Cod Fisheries of Central Alaska for 1905, 1906, and 1907.

Products.	1905.		1906.		1907.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cod, salted	5,492,000	$180,710	3,126,434	$110,473	4,505,096	$146,252
Cod tongues, salted	7,975	432	7,000	350	1,300	120
Cod-liver oil			[a] 1,800	84		
Cod roe, salted	2,060	82				
Total	5,502,035	181,224	3,135,234	110,907	4,506,396	146,372

[a] Represents 240 gallons.

VESSEL FISHING.

A fleet of 10 vessels, with headquarters in California or Washington, operated in Alaska waters this year. Some of the vessels spent the winter of 1906–7 in the north, but met with very little success. The only addition to this fleet in 1907 was the schooner *Martha II*. The schooner *Lizzie Colby*, formerly owned and operated by J. A. Matheson, of Anacortes, Wash., was sold early in the year, and did not engage in fishing. Nearly all of this fleet operated, during the summer at least, in Bering Sea, and all met with little success. Considerable complaint was heard again this year in regard to certain vessels' practice of dumping their gurry on the banks; which is said to drive the fish away.

On September 30, the schooner *Glen*, belonging to the Pacific States Trading Company, of San Francisco, was wrecked in Ikitak Bay, Unimak Island. One of her crew was drowned and 28,000 fish were lost. Other casualties during the year were a fisherman lost from the schooner *Dora Bluhm*, of San Francisco, and one lost from the schooner *Hunter*, of San Francisco.

The bait question, which is a very serious one to the fishermen of the Atlantic coast, causes no anxiety to the Pacific fishermen. Halibut, sculpins, and cuttlefish are the principal bait used, and large quantities of these are secured in fishing for cod.

The scarcity of labor for service as fishermen is a serious difficulty to the vessel owners. The greater part of the fishermen on most of the vessels are picked up along the water fronts of the coast cities, and most crews contain only a few good men. In 1906 the Robinson Fisheries Company brought 40 experienced cod fishermen from Gloucester, Mass., and this year a number were brought from the same place by the Union Fish Company.

The vessels from Puget Sound ports operating in Alaska waters caught 860,264 fish, while those from San Francisco caught 779,119, a total of 1,639,383 fish. In addition a fleet of 4 San Francisco vessels operated in the Okhotsk Sea, but had a most disastrous season, only about 251,800 fish being secured. As the headquarters of this fleet are outside of the district, none of these data are included in the statistical tables of this report.

THE HALIBUT FISHERY.

This choice food fish occupies a most important position in the commercial fisheries of Alaska. At present the industry is restricted to southeast Alaska, largely because of the fact that central and western Alaska are too remote for present steamship facilities. Trustworthy reports from Cook Inlet are to the effect that halibut are scattered practically all around the inlet, although in what abundance is not

known at the present time. They are also reported all along the Alaska peninsula and the adjacent islands, and also in Prince William Sound. This year the former revenue cutter *Grant*, which is now engaged in halibut fishing, after towing a salmon salting outfit to Kenai, in Cook Inlet, prospected for halibut between there and Rose Spit, on Queen Charlotte Island, at the lower side of Dixon Entrance. Although trawls were set frequently, practically no halibut were secured, but the master of the steamer thinks that this might be due to the merely temporary absence of the fish, as he found none in the vicinity of Rose Spit, one of the best fishing places on the coast, upon his arrival there. Mud bottom was found quite generally in Cook Inlet and the Gulf of Alaska, which is considered by the fishermen an unfavorable indication.

In southeast Alaska the fish appear to be most abundant in the numerous bays, sounds, and straits during the winter months. Icy, Chatham, Peril, and Sumner straits and Frederick Sound are the chief centers of abundance, the fishermen quite generally using Wrangell Narrows as the shipping point. Indians fish considerably in Boca de Quadra and the vicinity of Kah Shakes Cove, Marys Island, and the mouths of Kasaan Bay and Cholmondeley Sound. In summer the greater part of the fishing is carried on in Icy and Chatham straits and Stephens Passage. Halibut are generally plentiful in Icy Straits at all seasons.

METHODS AND CONDITIONS.

In summer the fish are scattered considerably, but during the winter they school on banks in the waters noted above. In this season the greater part of the year's catch is made, every available craft being pressed into service.

Dealers located at Tee Harbor, Juneau, Douglas, Scow Bay, and Ketchikan handle the fish from the fishing boats. Scow Bay, which is on Wrangell Narrows, about 5 miles from its head, is the principal shipping point. Here are moored several large house scows and floats, alongside of which the fishing boats tie up and deliver their catch, to be boxed in ice for shipment and put aboard the regular steamers for Seattle, which pass through the Narrows every few days. The fish are cleaned before being delivered at the scows, and the fishermen furnish their own ice, which is secured from near-by glaciers. The dealer furnishes the shooks for making the boxes. The latter will hold about 500 pounds of fish and cost 75 cents each to make.

Halibut weighing over 80 pounds are usually fletched aboard the vessel by the fishermen. In this process the sides are taken off in two complete pieces, which are then put into bins and buried in salt so that the brine will run off. It usually requires about three weeks for the fish to strike properly. Half ground California salt is used in

curing. The fishermen fletch, usually, as a last resort and because they can not dispose of the fish in any other way, although occasionally in summer a few of the vessels make regular fletching cruises.

Frequently the dealers make a contract with a vessel owner to take all of his catch for the season at a certain fixed figure, but when the fish are received on consignment the commission charged is generally 5 per cent. The dealers usually purchase outright, at the current rates, the fish landed by the small boats. A serious handicap under which the Scow Bay dealers and fishermen labor at present is the difficulty of sending and receiving cable messages. At the present time the nearest cable office is at Wrangell, about 35 miles away, and as the regular steamers touch at Scow Bay only on two days a week, it is frequently necessary to dispatch a boat specially in order to send off a message from Wrangell, while messages received at that office are held until the first mail steamer arriving after the receipt of the message leaves Wrangell for the north. The establishment of a branch office of the Government cable at Petersburg, at the head of the Narrows, would be welcomed not only by the halibut dealers and fishermen, but also by the salmon men who congregate here in the summer months.

Fishing vessels usually carry from 3 to 7 men and from 1 to 3 dories. This allows 2 men to a dory, while the cook remains aboard and maneuvers the vessel when necessary. The lay is usually as follows: All expenses are taken out of the gross proceeds, the vessel receives one-fifth of the net proceeds, and the rest is divided equally among the crew. Should the captain own the vessel he also receives his share as a fisherman. The vessel furnishes the outfit at the commencement of the season, but after that all fishing gear bought to replace that lost or worn out is counted as part of the expenses. Some few vessel owners furnish vessel and everything necessary but provisions, and pay the fishermen 27 cents each for fish 15 pounds and over; all below 15 pounds count 3 for 1.

On the launches and small boats the owner gets one-fifth of the gross proceeds for the use of the boat, and the balance is then divided equally between the men fishing, the crew furnishing everything but the launch.

Trawls are employed almost exclusively. The quantity used to a boat varies considerably. In the upper portion of southeast Alaska a dory will have out from 5 to 7 skates. A skate comprises 7 lines of 50 fathoms each, and each of these lines will have about 25 hooks on gangions, or side lines, which are set 6 feet apart. The no. 6283 "English" fishhook is generally used by the white fishermen, but the Indians employ a hook of their own manufacture. The shank of the latter is of wood, sometimes elaborately carved, with a metal tip. In the lower part of southeast Alaska from 2 to 4 skates to the dory are generally used. Ordinarily there is an anchor

and a buoy at each end of a skate, but for deep-water fishing an extra anchor and buoy are placed about the middle of the skate.

In fishing the trawls are set twice each day. The first set is made at about daybreak and the fishermen commence to lift about an hour after the line has all been paid out. The next set is usually made about 12 or 1 o'clock in the afternoon and the line is allowed to remain down about an hour. In the winter season usually but one set a day is made, while only about two-thirds of the usual gear is employed. The trawls are generally set in about 100 fathoms, although sometimes as deep as 300 fathoms. Fishing is continued during all stages of the tide, although some of the fishermen consider the morning flood as the best.

Large halibut are occasionally taken, one being delivered at Juneau in 1904 which weighed 365 pounds. According to the superintendent of the Tee Harbor halibut station of the International Fisheries Company, the females appear to have well-developed eggs at all seasons of the year. This summer, one of the authors opened a halibut measuring about 3½ feet in length and found in its stomach 22 good-sized herring.

From Juneau the steamer rates to Seattle on fresh halibut are $7.50 per ton when the shipment comprises 6 or more boxes (6 boxes are considered to weigh 2½ tons), but when the shipment consists of less than 6 boxes the rate is $9 per ton. Wharfage in Juneau is $1 per ton and in Seattle 40 cents.

In the spring the New England Fish Company, an American corporation with headquarters at Vancouver, British Columbia, which operates a fleet of steamers some of which fly the American flag and some the Canadian flag, purchased a large tract of ground in Ketchikan. This property is situated on the water front, and while no use has been made of it as yet, the company will eventually, it is said, establish a large halibut station here.

The Northwestern Marine Company, of Seattle, Wash., was incorporated under the laws of Washington in September of this year. According to the officials of the company it is their purpose to establish a large fishing station in Alaska, preferably at Ketchikan. Attached to this will be a fertilizer plant, at which the offal and nonedible fishes can be treated. The station is to be primarily for halibut, although other fish will be handled. Several steamers, fitted with beam trawls, will do the fishing. It is a question whether beam trawls can be profitably employed on this coast, as there is practically no market for any of the catch except halibut. A British Columbia company gave this form of apparatus a thorough test in 1906, and soon abandoned it as unprofitable.

The Pacific Fisheries Company, of Tacoma, was incorporated in September and will have a fleet of steamers engaged in fishing for halibut along the Washington, British Columbia, and Alaska coasts.

While the catch of halibut in Washington and British Columbia waters was very good this year, the same can not be said for the local fleet in Alaska waters. Despite the fact that 1907 shows a large increase over the two previous seasons in number of persons employed and vessels engaged in fishing, together with an increase in the quantity of apparatus used, the catch is but 287,578 pounds more than that obtained in 1906, while it is 233,895 pounds less than in 1905. The gross proceeds in 1907 were less than in any of the three years in question. It is quite evident that the fishery in southeast Alaska, at least, has reached its maximum development, if it has not already begun to decline. The banks are not very extensive in this section, and most of them are frequented by the fish only about six months of the year (October to March). At times the fishery is prosecuted so vigorously on certain of the banks that they are swept clean of halibut early in the season, and the fish are followed up so closely in their migrations from bank to bank that they have no rest until upon the approach of warm weather, when they scatter and seek the deeper waters.

STATISTICS.

During 1907 there were 591 persons employed in all branches of the industry, an increase of 287 over 1906. There were 14 steamers and launches and 15 sailing vessels engaged in fishing in 1907, an increase over 1906 of 10 steamers and launches and 1 sailing vessel. The total investment increased from $106,702 in 1906 to $164,126 in 1907. Despite the large increase in men, fishing vessels, and apparatus over previous years, the catch was but 287,587 pounds over that of 1906, while it was 233,895 pounds less than in 1905. Although the quantity taken was larger in 1907 than in 1906, the total value was $17,567 less than in the latter year.

The following tables show in detail the condition of the industry in 1907:

Employees in the Alaska Halibut Fisheries in 1907.

Occupation and race.	Number.	Occupation and race.	Number.
Fishermen:		Shoresmen:	
Vessel fisheries—		Whites	19
Whites	121	Japanese	1
Indians	11	Indians	5
Total	132	Total	25
Shore fisheries—		Transporters:	
Whites	38	Whites	26
Indians	136	Indians	2
Total	274	Total	28
Total fishermen	406	Grand total	591

INVESTMENT IN AND PRODUCTS OF THE ALASKA HALIBUT FISHERIES IN 1907.

Items.	Number.	Value.
Fishing vessels:		
Steamers and launches	14	$90,400
Tonnage	214	
Sailing	15	11,907
Tonnage	145	
Transporting vessels:		
Steamers and launches	4	19,220
Tonnage	52	
Boats	116	20,050
Apparatus:		
Vessel fisheries, trawl lines		5,460
Shore fisheries, trawl lines		6,089
Shore and accessory property		11,000
Total		164,126

Products.	Round weight.	Dressed weight.	Value.
	Pounds.	Pounds.	
Halibut, fresh	3,630,256	2,904,205	$109,293
Halibut, frozen	375,000	300,000	15,286
Halibut, fletched	482,362	385,890	16,172
Total	4,487,618	3,590,095	140,751

THE PUGET SOUND FISHING FLEET.

A fleet of Puget Sound power and sail vessels visits southeast Alaska during the months from October to March, when, owing to stormy weather and a scarcity of fish, it is not safe or profitable to visit the fishing banks near their home ports. This fleet makes its headquarters mainly at Petersburg, at the head of Wrangell Narrows, shipping the catch home from Scow Bay, near by, via the regular steamship lines. During 1907 this fleet comprised 15 power and 15 sail vessels, with a net tonnage of 475 tons and a value of $58,200, an increase of 7 over the number of vessels used in 1906. This fleet was manned by 159 men and used 65 dories and $5,850 worth of trawl lines. The catch amounted to 2,640,489 pounds of halibut, dressed, valued at $98,025, a gain over 1906 of 637,819 pounds in quantity and of $17,144 in value. At the end of the fishing season in the spring most of the vessels return to their home ports, but a few are put into summer quarters in the little streams and bays of Wrangell Narrows until needed the next fall. In addition to the above an ever-increasing fleet of steamers from Puget Sound and British Columbia also fishes occasionally in Alaska, but it has been found impossible to secure accurate data as to the quantity taken in these waters. These vessels return to their home ports as soon as a full fare has been secured. None of the data relating to this fleet have been included in the statistical tables of this report.

THE HERRING FISHERY.

Herring are quite abundant at times along the coasts of southeast and central Alaska, and possibly would be found in considerable abundance in western Alaska if the matter were to be looked into

carefully. Residents of Port Heiden, in Bering Sea, report that large schools of herring visit that bay in the spring and fall. The schools generally visit Cook Inlet, in central Alaska, from July to October, and these fish are said to be very large and choice. Unfortunately, but little use is made of the herring as a food fish in central and western Alaska (except at Simeonof Island), only a few barrels being put up for home use by the residents. This year, however, a herring saltery was established by Mr. James Osmond on Simeonof Island, one of the Shumagin group which is said to be visited annually by large schools of fine herring. A great difficulty in this fishery is the erratic movements of the fish. They may visit a bay for three or four years in succession, and then, without any apparent reason, avoid it for a season or two or altogether.

In southeast Alaska the herring fishery has attained considerable importance. Here the fish are found throughout most of the bays, sounds, and straits, where they are caught with haul and purse seines and gill nets. They are sold fresh for food and as bait in the halibut fisheries, salted for food and as bait, and smoked for food, while a few of the eggs, dried, are sold for food. A very fair season was experienced in 1907. The following table shows the condition of the industry in 1907:

EMPLOYEES AND INVESTMENT IN, AND PRODUCTS OF, THE ALASKA HERRING FISHERIES IN 1907.

Items.	Unit of quantity.	Southeast Alaska.		Central Alaska.		Total.	
		Number.	Value.	Number.	Value.	Number.	Value.
Employees.							
Fishermen:							
Whites		66		16		82	
Shoresmen:							
Whites		8		2		10	
Indians		8		2		10	
Total		16		4		20	
Grand total		82		20		102	
Investment.							
Fishing vessels (sail)				2	$4,000	2	$4,000
Tonnage				56		56	
Boats		32	$3,755	12	480	44	4,235
Apparatus:							
Haul seines		14	4,450	3	375	[a] 17	4,825
Purse seines		4	3,900			[b] 4	3,900
Gill nets		8	800	10	500	[c] 18	1,300
Shore and accessory property			13,350		1,200		14,550
Total			26,255		6,555		32,810
Products.							
Herring, fresh, for food	Pounds			12,000	360	12,000	360
Herring, fresh, for bait	Barrels	3,250	4,875			3,250	4,875
Herring, salted, for bait	Barrels	3,750	9,375			3,750	9,375
Herring, salted, for food	Half barrels	880	3,184			880	3,184
	Barrels	2,136	15,955	360	2,670	2,496	18,625
Herring, smoked	Pounds	22,940	780			22,940	780
Herring eggs, dried	Pounds	600	20			600	20
Total			34,189		3,030		37,219

[a] 3,520 yards in length. [b] 980 yards in length. [c] 2,600 yards in length.

FERTILIZER AND OIL.

The objection to the use of herring, salmon, and other food fishes for fertilizer and oil, which was treated in detail in last year's report, is still urged by many of the residents. As in 1906, there is but one fertilizer plant—that of the Alaska Oil and Guano Company, at Killisnoo—engaged in the industry to any extent, and it is to the operations of this company that most of the objection is made. In 1906 this establishment handled 33,500 barrels of herring and 18,000 barrels of salmon (principally dog and humpback salmon), while in 1907 there were utilized but 24,800 barrels of herring and 4,900 barrels of salmon, a very considerable decrease. A very small part of these were salted for food. Two steamers were used in fishing in 1906, while but one was so employed in 1907. The fertilizer prepared this year at Killisnoo amounted to 502 tons from herring, valued at $17,020, and 88 tons from salmon, valued at $2,980; while the oil extracted amounted to 80,877 gallons from herring, valued at $16,175, and 14,123 gallons from salmon, valued at $2,825.

Late in 1906 a small fertilizer plant was established by the Hume Fertilizer Company, at Scow Bay, on Wrangell Narrows, for the purpose of utilizing herring. The plant was very crude, however, and for fertilizer operations was soon abandoned. Its output amounted to 5 tons of fertilizer and about 805 gallons of oil.

The fertilizer plant installed in the barge *Enoch Talbot* at Pleasant Bay, in 1905, was removed from the vessel in 1906 and installed ashore, but it has never been operated, nor has the small plant installed in connection with the Tonka cannery.

A small quantity of oil from shark livers was prepared in central Alaska.

AQUATIC FURS.

BEAVER.

The production of beaver is steadily declining. At one time the animals were quite plentiful on the Alaska Peninsula, but in the last few years have become practically extinct in this section. The greater part of the present supply comes from the Yukon River and its tributaries. A few are secured from the Kenai Peninsula. In 1905 the catch amounted to 1,935 skins, valued at $8,271; in 1906 to 1,536 skins, valued at $8,620, while in 1907 it had decreased to 1,159 skins, valued at $6,154. In 1907 22 pounds of beaver castors, valued at $33, were also secured.

MUSKRAT.

Most of the muskrat skins obtained by the trappers are used by the traders in barter with the natives for more valuable furs, hence but few are exported, and as the last are the ones of which an accurate

record is kept, the muskrat occupies an apparently insignificant place in Alaska's commerce. The natives use the fur for clothing and blankets or robes. In 1905 12,599 skins, valued at $1,192, in 1906 3,611 skins, valued at $302, and in 1907 6,481 skins, valued at $494, were shipped out of the district. The greater part of these came from the Yukon valley.

LAND OTTER.

This valuable animal is found mainly in the regions adjacent to the coast and is very widely distributed. Southeast, central, and western Alaska yield practically the same catch. Like the other aquatic furs from Alaska the output is steadily on the decline. In 1905 the catch amounted to 1,889 skins, valued at $14,458; in 1906, to 1,709 skins, valued at $16,618, while in 1907 but 1,393 skins, valued at $12,695, were secured.

SEA OTTER.

The yield of this extremely valuable fur is still diminishing, and it is probably only a question of a few years before the animal will become extinct. At the present time the pursuit of it is so precarious that but two schooners fitted out for the hunt in 1907. The schooner *Challenge* (owned by Henry Dirks, of Atka Island) did not outfit this year, but was taken to Puget Sound to be overhauled and equipped with a gasoline engine. The owner outfitted a number of natives with bidarkas for a hunting season in the neighborhood of the Rat Islands, but no news from these natives can be expected until the spring of 1908. The two vessels noted below operated on the Sannak Reefs in very unfavorable weather, the *Everett Hayes* hunting from May 12 to August 25, having during that time only 119 suitable hours. The *Emma* was out in July only.

The fleet and catch in 1907 is shown in the following table:

Name of vessel.	Port.	Tonnage.	Value.	Crew.	Indian hunters.	Boats.		Sea otters.	
						Number.	Value.	Number.	Value.
Schooner Everett Hays.	Unalaska..	37	$2,000	3	20	10	$150	6	$900
Schooner Emma........	Marzovia..	24	1,500	3	20	10	150	2	300
Total............	....	61	3,500	6	40	20	300	8	1,200

In addition to the catch shown above, 8 sea otters, valued at $2,808, were killed in various ways (2 were picked up on the shores of Kadiak Island), making a total catch by Alaskans of 16 sea otters, valued at $4,008, a decrease of 12 skins and $821 as compared with 1906. The catch in 1905 was 61, valued at $13,867.

An odd, but sometimes very profitable, business is that of patrolling certain beaches on the watch for the bodies of sea otters which may be washed up. The work is carried on in the fall, winter, and

spring months, when the ice is abundant. The otters, in playing about the moving ice, are sometimes caught and crushed to death, and occasionally the dead carcass is carried by the ice or the waves up onto the beach. Mr. Charles Rosenberg has two or three stations on the Bering Sea side of Unimak Island and covers 10 to 12 miles in his patrol. During the winter of 1905–6 he secured 10 otters in this way; during the winter of 1906–7, however, but 1 was found. A few years ago Charles Peterson patrolled the beach from Isenbeck Bay to Blind Pass. This was at one time a favorite method on the islands adjacent to the Pacific side of the peninsula, upon which otters which had been killed by the hunters and not secured would be washed up. Certain islands were especially favored in this regard owing to the prevailing winds in their direction during the hunting season.

The British Columbia sealing schooner *Casco*, which cruised in the North Pacific Ocean this year, secured 18 sea-otter skins. (This same schooner secured 12 in 1906.) Other vessels of the fleet took 20 sea otters, making a total catch of 38.

Early in the year a complaint was received from Mr. Charles Rosenberg that his sea-otter stations on Unimak Island, in which he had stored considerable supplies, were plundered by Japanese seal hunters during his absence in the summer of 1906, and a large part of the supplies stolen.

FUR SEAL.

The shipment of fur seal skins by the lessees of the Pribilof Islands was 12,384 from St. Paul Island, and 2,580 from St. George Island, a total of 14,964 skins for the group. At the time of going to press with this report all of these skins had not yet been auctioned off in the London market, but estimating those unsold on the basis of the prices received for the already disposed of lots, the value of the total shipment from the islands amounted to $475,107. In 1906 there were shipped from the islands 14,476 skins, which sold for $445,137. In addition to the above in 1907 there were 405 fur-seal skins, valued at $9,042 (this represents the price paid to the hunters for these skins and not the London price), taken in southeast Alaska, and 25 skins, valued at $500, taken in central Alaska, making a total of 430 skins, valued at $9,542, taken by Alaskan natives, which, added to the skins shipped from the Pribilof Islands, makes a grand total of 15,394 skins shipped from Alaska. It is highly probable that the skins of several hundred illegally killed fur seals are smuggled out of Alaska each year despite the vigorous efforts to enforce the law forbidding such shipments.

Aside from the Pribilof Islands, the Indians of Sitka are the only Alaskan natives who engage actively and as a regular business in the

hunting of the fur seal. Under the laws in force at present only Indians can kill fur seals. When the animals in their northward migration to Bering Sea reach the neighborhood of Baranof Island, on which Sitka is located, during the month of May, the natives go out in small sailboats and canoes and hunt them with guns. This year they secured 355 skins, which, owing to the spirited competition, sold for $23 each, a very high price. These skins are much sought after by the dealers because, being taken by natives, and a certificate from the collector of customs certifying to this being attached to each, they can, under the law, be sent abroad to be cleaned and dyed, and then can be brought back and sold in our markets. The possession of such a certificate is considered to add about $10 to the value of the skin.

The pelagic fleet hailing from British Columbia, and working on the northern herd, was composed this year of 15 vessels, and its catch amounted to 2,858 skins from Bering Sea, 448 from Copper Island, 1,934 from the British Columbia-Alaska Coast, a total of 5,240, while 157 were taken by Indians in canoes along the coast, a grand total for British Columbia of 5,397 skins. In 1906, 17 vessels caught 7,983 seals in Bering Sea, and 1,403 from along the coast, a total of 9,386. In 1905 the Bering Sea catch of the fleet amounted to 10,832 skins.

A Japanese pelagic fleet, estimated to comprise 36 vessels, also hunted in Bering Sea and the North Pacific Ocean and secured about 9,000 seals. As this fleet is not bound by the restrictions of the international agreement between Great Britain and this country, it hunted when, where, and as it pleased outside the 3-mile limit. But even this practically free hand did not satisfy some of the Japanese. On July 3 the revenue cutter *Manning* discovered boats from the schooners *Nitto Maru*, *Kaiwo*, and *Kompiro* inside the 3-mile limit near Southwest Bay, St. Paul Island, and promptly seized all three vessels. As there was a doubt as to the guilt of the *Kompiro*, she was released with the customary warning. The *Nitto Maru* and *Kaiwo* were towed to Unalaska, where the crews were taken off the vessels and put aboard the *Manning*, which carried them to Valdez in August for trial. The captain and 6 members of the crew of the *Nitto Maru* were found guilty, were fined respectively $500 and $200 each, and the vessel was ordered to be libeled. The government later ordered her release. Three members of the crew of the *Kaiwo* were convicted and fined $300 each. Nearly all the fines were paid by the companies operating the vessels. On June 17 the Japanese schooner *Mei Maru* was seized by the revenue cutter *Perry*, charged with having boats sealing within the 3-mile limit, but she was later released, as the evidence was not conclusive.

The schooner *Kaiwo* proved to have had an eventful career. She was built at Gloucester, Mass., and for some years was engaged in

mackerel fishing under the name of the *Henry Dennis*. In 1888 she came around the Horn to join the pelagic sealing fleet and in 1891 was seized for illegal sealing. Subsequently she was caught by a tidal wave and wrecked on the Japanese coast, was then floated and repaired, and has since sailed under the Japanese flag.

On May 29 the revenue cutter *Rush* captured the British Columbia sealing schooner *Carlotta G. Cox* about 14 miles off Yakutat Bay, charged with sealing before the opening of the season. There were 77 skins aboard the vessel and 5 seemed to be of freshly killed seals. She was towed to Port Simpson and turned over to the Dominion government for trial, was convicted and subjected to a heavy fine.

Owing to the restrictions under which the British Columbia fleet labors at present, certain of the owners have decided to place their boats under the Japanese flag. The schooner *Umbrina* left early in 1908 for Japan in order to secure a register from that country. It is to be feared that others of the fleet will follow the example of these and thus the restrictions promulgated by the Paris tribunal will be evaded, soon undoubtedly resulting in the total destruction of the seal herd.

MISCELLANEOUS AQUATIC MAMMALS.

HAIR SEALS.

This fairly common and quite generally distributed animal is probably the most useful aquatic product the natives hunt, for from the flesh and oil is secured a considerable part of their winter food, while those skins not sold to traders are put to many useful purposes. The skins, flesh, and oil are also used by the coast natives in barter with the interior tribes. Only a small portion of the skins are shipped from Alaska, the number this year being 25,139, valued at $13,354. This is a large increase over 1906, when 17,684 skins, valued at $12,332, were shipped.

WALRUS.

This animal is sought mainly for its ivory tusks. At one time it was quite plentiful in Bering Sea, but at present there is to be found only one small herd, which hauls out on the small islands off Port Heiden, on the Alaska Peninsula. They appear here in the spring and fall. The natives occasionally catch one, but this is a rather difficult matter as the animals are very wary and sleep lightly. The meat and oil is used by the natives as food, while the ivory is sold to the traders. On the Bering Sea side of the Alaska Peninsula, the natives pick up considerable ivory on the beach each year, where it has been uncovered by the action of the ice and waves. The main herd, which is now quite small, is found in the Arctic Ocean. This year 19 skins, 4 heads, 8,189 pounds of ivory, and 5 pounds of teeth were shipped out of Alaska.

BELUGA, OR WHITE WHALE.

The beluga is much sought after by the natives, who use it for food and other purposes. It is quite abundant in Cook Inlet, in central Alaska, and in Bristol Bay, where the natives pursue it in bidarkas with guns and spears. The spears have large skin floats attached, which when the animal is struck hamper its movements and also help to keep it at the surface before and after death. In Bristol Bay the beluga appears in June and remains until freezing weather sets in. The natives consume all products secured, none being sold.

WHALES.

Early in 1907 the whaling station of the Tyee Company at Tyee, in Murder Cove, at the lower end of Admiralty Island, in southeast Alaska, was completed, but as the steamer to be used in whaling was not ready for delivery until autumn, the station was operated but a few weeks before the end of the season. Eight whales were secured, but as none of the products had been marketed at the close of the year, it has been thought best not to show these in the statistical tables for this year, but to include the prepared products in next year's report. The company employs from 90 to 100 men and uses the Svend Foyn method in killing the whales. It is the intention to prepare oil and fertilizer from the catch. The balæna from the gills will be saved, and while this is not as good as the whalebone from the right whale, yet it has a fair value. The cleaned bones of the whales will be shipped. This station is very favorably situated for whaling, as the waters adjacent to it are the haunts of large schools of finback, sulphur-bottom, and humpback whales.

The operation of what might be called floating whaling stations in Alaska waters is being considered by certain Norwegian interests. A large steamer equipped with tanks for whale oil and carrying coal, barrels, etc., and the machinery for trying out the blubber, together with a couple of small steamers to be used in catching the whales, would be the equipment used.

After an absence of over two years, nearly all of the Arctic Ocean whaling fleet, with headquarters in San Francisco, returned late in the fall with the biggest catch in years. The 8 vessels of the fleet caught about 82 whales, which, at the high prices prevailing for whalebone, will net the owners a handsome profit. Each vessel reported whales very abundant this year. As this fleet has its headquarters in California, nothing relating to it appears in the statistical tables of this report.

The natives along the Arctic shore of Alaska do some hunting with small boats for whales and walrus, and sell the ivory and bone secured to the whalers. This year the natives at whaling stations east of

Point Barrow captured 9 whales, an exceedingly good catch. The products secured by the natives appear in the statistical tables.

MISCELLANEOUS FISHERY RESOURCES.

Black cod (*Anoplopoma fimbria*).—This fish is becoming better appreciated each season, and this year was not only sold fresh, but a part of the catch was frozen and pickled. The fish frequents many of the halibut banks, and most of the catch this year was taken incidentally on the trawls set in Chatham Straits for halibut. A favorite spot is in a deep hole (about 414 feet on the edges) from 1 mile to 1½ miles off Funter Bay. Another good fishing ground is off Point Hugh, in Stephens Passage. The fishermen believe that the black cod migrate, apparently following the salmon; salmon are often found in their stomachs. While the true cod makes excellent bait for other fishes, the opposite is the case with the black cod.

Capelin (*Mallotus villosus*) are quite abundant in the coastal waters of Alaska, especially on the cod banks, where they form a considerable part of the food of the cod. Large numbers are said to be washed up on the beach in the neighborhood of Sitka in October. The fish remain in this neighborhood about a week, and large quantities are consumed locally by both whites and natives. Schools appear in Glacier Bay in May and June. According to residents of Port Heiden, in Bering Sea, capelin appear there in June and July, and are sometimes washed up on the beach ankle deep for miles.

Eulachon (*Thaleichthys pacificus*).—This species, the well-known candle-fish, is highly prized by the natives for its excellent food qualities, while the oil and a grease extracted from the fish are favorite condiments with them. A local and export trade is being built up in southeast Alaska.

The eulachon frequents in considerable numbers, but for very short periods of time, the Unuk, Stikine, and Chilkat rivers, Dyea and Berners bays, and Excursion Inlet. It is also found in very limited abundance in a number of other bays and rivers. In the upper part of southeast Alaska the time of the best run is the big spring tide in May (about the 15th) when the fish are said to run for three days, during which, in the rivers, the fishermen (mainly natives) capture them by means of dip nets. This year there was an unusually large run. In central Alaska large schools are known to frequent the more important rivers of Cook Inlet, but, as in southeast Alaska, their stay is exceedingly brief. On the Alaska Peninsula, at Three Star Point (approximately opposite Unga Island) there is said to be a large run of eulachons in May. So many are left stranded on the beach that the bears are attracted from miles around to feed upon them. In western Alaska the eulachon frequents the Ugashik River and probably other rivers in the Bristol Bay region.

Smelt (*Hypomesus olidus*).—There is an annual run of smelt in most of the streams of western Alaska, especially the Yukon, where it is of considerable importance, but the fish is taken only for local consumption. The smelt enter Port Heiden, on the Bering Sea side of the Alaska Peninsula, in large numbers about October and remain until the early part of the following June. There is no information available as to what rivers, if any, they frequent in central Alaska. In southeast Alaska they are found quite generally distributed. In the fall there is quite a large run in Wrangell Narrows. In 1906 one of the halibut dealers at this point made a trial shipment of 500 pounds to New York City, with such success that the consignee telegraphed for a carload, but as the run was over it was impossible to comply. The smelt appears to frequent the waters of southeast Alaska from about October until the following June; it is frequently found in the stomachs of king salmon.

Trout.—There are 5 species of trout known from Alaska—namely, steelhead, Dolly Varden, cut-throat, rainbow, and lake. Of these the Dolly Varden, rainbow, and steelhead are handled commercially, the latter being sold fresh, frozen, and pickled. The Dolly Varden trout is especially abundant throughout the greater part of southeast, central, and western Alaska. Several fishermen at Wrangell Narrows began catching and shipping Dolly Varden trout this summer, but the fishery authorities of Washington, classing it as a game fish, objected not only to the sale in that State, but also to the shipment into it, and the steamship companies consequently refused to receive them for shipment to Puget Sound. These trout are in such abundance in southeast Alaska that they have become a very serious menace to the salmon, many millions of whose eggs they consume each year, and if an outside market could be provided the salmon interests would be benefited, at the same time that a new industry would be created. Steelhead and Dolly Varden trout are reported as being found in Port Heiden, in Bering Sea.

Other fishes.—In addition to the above, a number of species of fish are found in Alaska, which form, in some instances, a very important portion of the food supply of the natives, and occasionally of the whites. Among the more important of these may be mentioned the following: Lampreys (*Lampetra aurea*), which are quite abundant on the Yukon River; tomcod or wachna (*Microgadus proximus*), very abundant in Bering Sea; whitefish (*Coregonus*), of which 7 species are reported, mainly from the tributaries of Bering Sea and the Arctic Ocean; pike (*Esox lucius*); Arctic grayling (*Thymallus signifer*); the inconnu (*Stenodus mackenzii*), a very large fish; burbot or losh (*Lota maculatus*); sucker (*Catostomus catostomus*); sculpins (*Cottidæ*); Atka mackerel (*Pleurogrammus monopterygius*), an excellent food fish, with a flavor like mackerel; blackfish (*Dallia pectoralis*); *Boreogadus saida*,

found in the Arctic; redfish, or "black bass" of Sitka (*Sebastodes melanops*); flounders, and sand launce, or lant.

Shellfish.—Clams, especially *Machæra patula*, or the razor clam, are found in abundance throughout southeast and central Alaska and have been reported from a few places in western Alaska. Very little use is made of them, owing to the fact that the consumer is compelled in most sections to go out and dig his own clams, the fishermen considering it below their dignity to engage in such work for pay. When the prejudice against engaging in this fishery and that for crabs, wears off, both will prove to be remunerative. There is said to be a bed of scallops in Funter Bay.

Crabs.—These crustaceans are quite abundant in southeast and central Alaska, where they attain a very large size. They are much sought after for food by the whites and natives, the consumers, however, being usually compelled to catch for themselves, as crabs can be purchased at but one or two towns in southeast Alaska.

Shrimp.—Shrimp are found in a number of places in southeast and central Alaska, but no commercial use is made of them. They are also reported from Bering Sea in the neighborhood of Herendeen Bay.

Algæ.—The Thlingit and Yakutat Indians of southeast Alaska gather algæ in the summer, which they dry, press in boxes, and put away to be eaten in winter. As certain species of algæ are very nutritious it is probable that some day they will come into use by the whites on the Pacific coast as food. A number of valuable by-products can be extracted from algæ.

In Seattle, Wash., there has been invented a process for making a product resembling citron (called by the inventors "seatron") from the giant kelp (*Nereocystis lutkeana*). The product has not the form of citron, being tubular, like sections of garden hose, although when made from the bulbs of the plant exclusively it resembles somewhat the halves of a citron. The larger portion of the stalk—from 1 inch up—is used. The process of manufacture is inexpensive and compares well with the cost of making candied citron. The flavor is of course artificial. The prepared product is said to contain no harmful properties and to be digestible to a greater degree than citron. This plant is very abundant in Alaskan waters, and it is to be hoped that some one with capital will take up the manufacture.

RECOMMENDATIONS.

The following recommendations are respectfully submitted:

1. That the salting of salmon bellies by the processes that do not now make any use of the other part of the fish, and thereby entail a serious waste of valuable food material, be prohibited.

2. That a cod hatchery be established on one of the Shumagin Islands in order to aid in perpetuating this valuable fishery.

3. That there be available in Alaska waters at least two vessels belonging to the Department of Commerce and Labor for the use of the Bureau of Fisheries in the salmon inspection. For work in southeast Alaska a comparatively small launch (about 60 feet long, 12 feet beam, and fitted with a 50 to 60 horsepower gasoline engine) would answer the requirements, as the waters to be traversed are comparatively protected and harbors are numerous. For the cruise to central and western Alaska a much larger vessel is needed, one at least of several hundred tons displacement, as the waters in these sections are open and storms are frequent.

The Canadian government has already two or three vessels of considerable size devoted to the protection of its fisheries on the British Columbia coast and will presently provide another and much larger one. The Alaskan territory involved is enormously greater in extent and the product much greater in value than the Canadian, but no vessel has yet been assigned to this work.

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THE FISHES OF THE CONNECTICUT LAKES AND NEIGHBORING WATERS, WITH NOTES ON THE PLANKTON ENVIRONMENT

By W. C. KENDALL and E. L. GOLDSBOROUGH

Bureau of Fisheries Document No. 633

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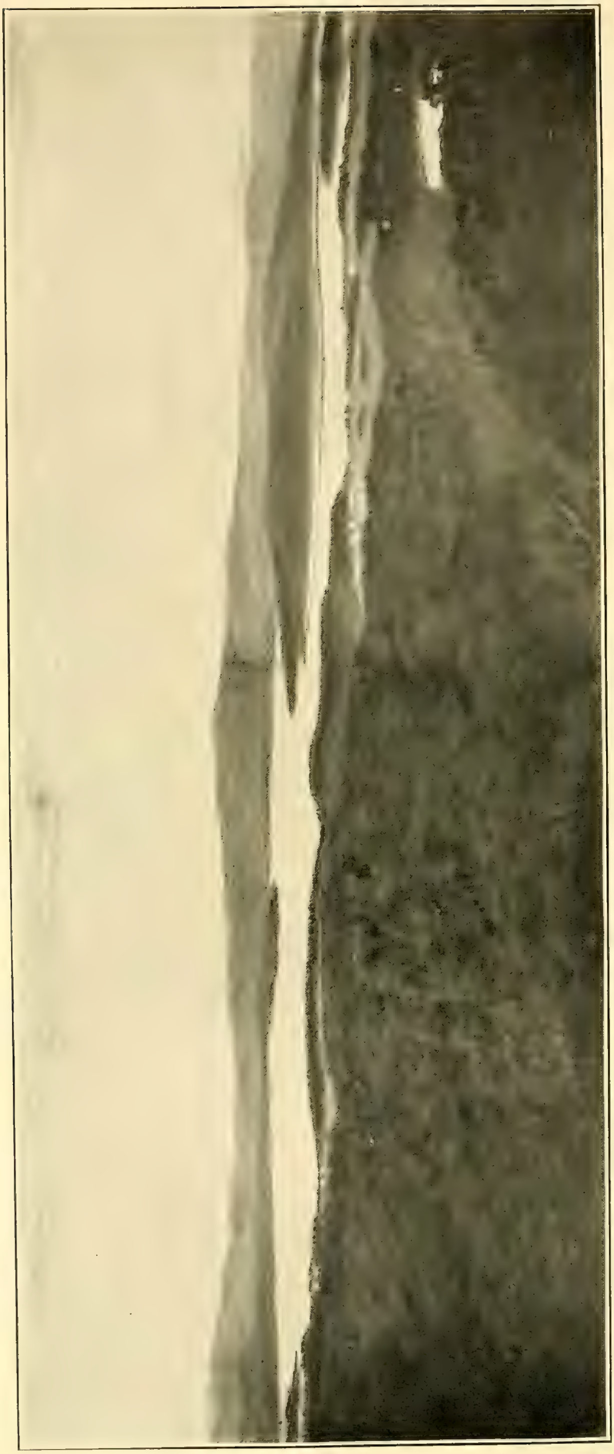


FIRST CONNECTICUT LAKE, LOOKING SOUTHEASTWARD.

THE FISHES OF THE CONNECTICUT LAKES AND NEIGHBORING WATERS, WITH NOTES ON THE PLANKTON ENVIRONMENT.

By W. C. Kendall and E. L. Goldsborough.

INTRODUCTION.

For a number of years the United States Fish Commission conducted biological and physical investigations of the inland waters of Maine; and appreciating the great importance of such work in conjunction with fish-cultural operations, the Bureau of Fisheries decided to continue it in other New England states. The Connecticut Lakes were selected for the next work [a] for several reasons. Their proximity to the Vermont, Maine, and Canadian borders gives them particular interest in their bearings on the geographic distribution of fishes; they are the largest lakes north of the White Mountains in New Hampshire; they have received some fish-cultural attention; and they are the source of the Connecticut River, the largest river in New England. The lateness of the season at which the investigations were taken up and the short time spent in the region detract somewhat from the results. Most spring and summer breeding fishes had nearly spawned when observations were commenced, and the work was brought to a close before fall spawning had begun. Therefore much desired knowledge on these points was not acquired.

The geographic distribution of the fishes of this region, however, was very well made out, also their relative abundance. The feeding habits of some of the species were closely observed and the relations of the fishes to their surrounding conditions were noted so far

[a] The authors and Mr. A. A. Doolittle, of the Central High School, Washington, D. C., constituted the investigating party. Doctor Kendall and Mr. Goldsborough gave their attention chiefly to the fishes and a general study of the local conditions. Mr. Doolittle studied the plankton environment and the macroscopic invertebrates and flora. His report is published herewith, appended to the present article.

as possible. Accordingly in these pages the discussion of these subjects is taken up under two headings—that is, geographic distribution and the fishes. The first is treated under two subdivisions—(1) natural distribution, dealing with the indigenous species, and (2) artificial distribution, the fish-cultural dissemination.

Necessarily incidental to the study of the relations of fishes to their environment is a knowledge of the geographic and physical features of the locality. These subjects being less specifically our field, however, we give only a general description of the waters examined and such conclusions as we are able to draw from our work.

Attempt is made to present the report in a form which will be of popular interest and practical use, and the fishes therefore are treated as untechnically as is consistent with exactness and conciseness. But since most residents in this region and all visiting anglers are greatly interested in the local fishes and fishing, and among them there exists more or less confusion regarding the identity of some of the indigenous and probably all the introduced species, it has been the effort to present the results of the study of the fishes in such manner as will enable anyone to identify all that he finds. To that end a simple artificial key is presented, with instructions regarding its use. The species are arranged in the order adopted by Jordan and Evermann in their Fishes of North and Middle America. Each species is then taken up in the following manner: The common name, followed by the technical name and original authority for it; then a brief structural and color description, taken when possible from specimens collected in the region under discussion. The most common local names are then given, followed by the recorded general range of the species and local distribution as indicated by our collections. This is followed by a description of the habits of the species and other interesting or important facts mainly drawn from our own observations; after this, uses and best methods of capture, in accordance with our experience in these waters in particular and in other places in general.

Photographs taken by ourselves in this region are used to illustrate this report, together with drawings and photographs of the introduced species and some of the native game and food fishes.

LOCAL GEOGRAPHY AND PHYSICAL FEATURES.

The Connecticut Lakes, three in number, situated in the northern part of Coos County, N. H., near the Canadian and Maine borders, having an average elevation of 1,850 feet, are the principal and practically the ultimate source of the Connecticut River. The surrounding country consists of low mountains with accompanying valleys and bogs characteristic of northern New England. Much of

the country from the north side of First Connecticut Lake down to the Vermont line has long been cleared and affords good farms, especially in the bottom lands of the river and its prinicpal tributaries. The remainder of the region is a vast forest extending north beyond the Canadian border, east far into Maine, and southward for many miles. The principal trees are spruce, fir, birches, and maples.

Lumbering operations formerly carried on here have been abandoned. But the dams and abutments that were built and the old log jams remain and have had a marked effect upon the conditions of the lakes and streams, and consequently upon their fauna and flora.

Regarding these lakes the state commissioners about ten years ago reported as follows:[a]

> The most northerly lakes in our State are the Connecticut Lakes. Within the last ten years they have become a famous resort for both the hunter and fisherman, the forests around them abounding in large game and their waters with both lake and speckled trout. Until quite recently it has not been deemed necessary to introduce into these waters any of the fry from our hatcheries, except some landlocked salmon, which were planted there by the commission in the days of the accomplished and genial Col. Sam Webber; and we are happy to state that within the last two years these lordly fish (which we believe will eventually become the most popular fish in the State) have come forward in considerable numbers and borne testimony to the wisdom and foresight of the aforesaid Colonel Webber. The late Colonel Hodge also planted 25,000 salmon in the tributaries of the First Connecticut Lake in the spring of 1892. The present commission, in view of the drain which is being made upon these waters by the numerous fishermen resorting thereto, are planting them with lake trout fry, of the New Found Lake variety, in large quantities; and it is our intention when we make our next distribution of fry to place in these waters, in addition to their quota of lake trout, a fair supply of brook trout and landlocked salmon, together with a quantity of fresh-water smelt as a food supply.

The principal waters of this region that came within the scope of our investigations, besides the three Connecticut Lakes, were their connecting and tributary streams and ponds and Indian and Perry streams. A brief general description of each follows.

Indian Stream.—This stream, which joins the Connecticut River about 13 miles below First Lake, has a very ramified source in the northern part of the state, its ultimate headwaters being on the Canadian boundary. Many of its uppermost branches are exceedingly close to streams flowing into the St. Francis River, which joins the St. Lawrence in " Lake St. Peter." Its course lies almost parallel

[a] Report of the Fish and Game Commission of New Hampshire to the Governor and Council, December, 1894.

with that of Halls Stream[a] and Perry Stream. Many of its eastern branches are intimately close to western tributaries of Perry Stream. One of the largest of these branches is "East Branch," which is a famous trout stream. Lying just west of Back Pond is a chain of three small ponds, the largest of which is less than one-half mile in diameter, which discharge their waters through one of the lower eastern branches into Indian Stream 7½ or 8 miles above its junction with the river. Two of the ponds are named Moose Pond and Bowen Pond, respectively, the latter being the largest of the three.

Indian Stream was examined from a point about 3 miles above the bridge over the main road down to the bridge. The bed of the stream is essentially gravelly; it is mostly shallow, with considerable descent and rapidity. In the distance of about a half mile or so above the bridge there were several deep holes having sandy and muddy bottoms. There were but few water plants. The stream averaged, perhaps, 30 feet in width at the time of our visit (August 4). The water was low and the bed to a great extent dry. In the spring there is sufficient water for log driving. In a field about a mile above the bridge there are a number of pools which are the remains of an overflow or "cut-off" at present not connected with the stream, but doubtless fed by springs. In these pools the following fishes were caught, some of them not obtained elsewhere in the region: Red-bellied minnow (*Chrosomus erythrogaster*), bronze minnow (*Leuciscus neogæus*), mud or brook chub (*Semotilus atromaculatus*), common chub (*S. bullaris*), longnose dace (*Rhinichthys cataractæ*), blacknose dace (*R. atronasus*), redfin (*Notropis cornutus*), young cusk or burbot (*Lota maculosa*), besides innumerable tadpoles and frogs (*Rana clamata* and *R. septentrionalis*). In the stream itself were taken chub, brook chub, longnose dace, longnose sucker (*Catostomus catostomus*), common sucker (*C. commersonii*), chub-minnow (*Couesius plumbeus*), and several blobs (*Cottus gracilis*). The temperature of the air was 70° and of the water 62° F.

Back Pond.—This pond is about 1⅛ miles long, with an extreme width of something over one-half mile. It is situated about 2½ miles above the junction of its outlet with the Connecticut River near Pittsburg. The main road to Connecticut Lakes, however, passes within sight of it. This pond was not visited, but it was learned from reliable sources that pickerel (*Esox reticulatus*) occur there as an introduced species, and trout are found in the outlet. It is said that Back Pond was once a good trout pond.

Perry Stream.—This stream has its source near the boundary line of northern New Hampshire and Canada in several small branches

[a] Halls Stream, forming a part of the boundary between New Hampshire and Canada, joins the Connecticut River near Beecher Falls, Vermont.

and three or four very small ponds, one of which is named Wrights Pond. Throughout its course it has many small tributary branches, one of which takes its rise in a small pond to the westward. Perry Stream joins the Connecticut River about 2 miles below First Connecticut Lake. It was examined from a point about 5 miles above its mouth to its junction with the river. Between $1\frac{1}{2}$ and 2 miles above the mouth of the stream there are several old dams. The section of the stream examined was less rapid in the upper 3 miles than below. Within this upper distance the bottom is sandy, but there are occasional riffles. There are numerous good trout pools, but evidently only a few trout. For the next mile or so down, the stream increases in size and the bottom consists of coarse angular fragments of the bed rock rather than bowlders. At the lower end there is about a mile of dead water occasionally interrupted by short riffles. There seemed to be but little aquatic vegetation; some algæ and pond weed were observed. The water of this stream is colder than that of Indian Stream. A few springs were observed to empty into it. The temperature of water of the stream on August 6 was 44° F., and of one of the springs 42°; the air was 76°.

The fishes obtained and observed were trout (*Salvelinus fontinalis*), longnose sucker (*C. catostomus*), and a few blobs (*Cottus gracilis*).

First Lake.—First Lake is the lowermost and largest of the chain, lying about latitude 45° 6′ north, longitude 71° 16′ west, at an elevation of 1,619 feet. It is very irregular in shape and approximately 4 miles long and 3 in extreme width. The long axis of the lake extends about east and west, but at its lower end curves to the south. The widest part of the lake is from the north shore to the south end of a deep cove known as South Bay. Stony Point marks the entrance to the bay on the east. Northeastward from this point, on the north shore of the lake, is Abbott Point, and correspondingly northwestward is Metallak Point. The distance from Stony Point to Abbott Point is a little over $1\frac{3}{8}$ miles and just about $1\frac{3}{8}$ miles from Stony Point to Metallak Point. A line joining the last two points marks the western limit of that portion of the lake which may be appropriately designated as East Bay, while a line extended to the opposite shore directly south from Metallak Point determines the eastern limit of the western section of the lake, which, for convenience, may be called West Bay.

With the exception of Main Inlet, the affluents of the lake are all small. On the south side there are some spring rivulets originating in the hills, of which Alder Brook, entering the lake on the southeast side of East Bay, is the largest. Main Inlet debouches into the lake on the northeast side of East Bay just east of Abbott Point. On the north side of the lake the most conspicuous tributaries are Mud

Pond Brook, the outlet of Mud Pond, and Round Pond Brook, outlet of Round Pond. The first joins the lake just east of Metallak Point and the other about halfway between Metallak Point and the mouth of Main Inlet.

The shores of the lake vary in character, on the south side being mainly rocky and somewhat bolder than on the north side. Immediately south of Main Inlet the shore is swampy. The rest of the east shore of East Bay around to Stony Point is variously sandy and rocky, but mostly sandy north of the mouth of Alder Brook. Close to Stony Point are two small islands and some submerged ledges and bowlders.

South Bay on the east and south side is mostly rocky; on the west side there are beaches composed of rocks, small bowlders, sand, and mud, through which cold spring water trickles into the lake in a number of places. It was here that some large fish were seen rising. The rest of the south shore of the lake is mainly rocky to the outlet. The north shore from Abbott Point to Metallak Point consists for the most part of a sand beach with occasional short stretches of rocks. At the mouths of the brooks it is somewhat swampy. From Metallak Point west for about three-fourths of a mile the shore is composed to a great extent of loose rocks and projecting jagged ledges in situ. This is followed by a swampy area, and on the northwest side a shallow cove is full of old stumps, logs, and dead trees, known in backwoods parlance as "dry kye."

The only muddy bottoms near shore are at the western end of the lake, the estuary-like entrance of Main Inlet, and the mouth of Mud Pond Brook. The northern and eastern shores present gravel and sand, respectively, and South Bay a stony offshore bottom, with a slight mud filling between the bowlders. Throughout the lake at large the character of the bottom is a very easily disturbed granular black dirt, into which the sounding lead sank 8 or 10 inches and reached a substratum of yellow slimy mud.

The history of the lake shows that the level of the water has been 2 to 3 feet higher than the level of the season of 1904. It was higher during the season of 1903. There is abundant evidence of former higher level of water on the shores, viz, the higher former shore line, almost bare beaches of sand and gravel; the dead standing trees whose roots have been covered by water during long periods; and the testimony of residents and visitors who find that the marshes and shallow feeding grounds of water and shore birds have largely disappeared. The present area of marshy ground contiguous to the lake is probably less than an acre. The level of the lake is now possibly near the level before the dam was built across the outlet.

The bottom of the lake at large gradually slopes from the shore to a depth of 70 feet, which is maintained over most of its area. The

nearer the point of entrance of Main Inlet, the more gradual the slope, due to the deposit of silt in freshet time. The depth in the immediate vicinity of the entrance is 4 to 6 feet, and a large part of this region ranges from 40 to 50 feet in depth. Around the shores of this lake there was no shallow littoral bench or shelf such as existed in the other lakes and ponds visited, but a fairly uniform descent to the deeper waters.

The offshore body of water is generally pretty deep. The deepest place found by numerous soundings was 140 feet, about three-fourths of a mile southeastward from Metallak Point and less than one-fourth mile northeastward of Greens Point, which is a little east of south of Metallak Point, near the entrance to South Bay. About halfway from Abbott Point to Stony Point there is a depth of 70 feet, toward the latter point shoaling to 50, then increasing to 70 feet again about one-fourth of a mile off the point. Off Abbott Point it rapidly deepens to 35 feet, and about halfway between this point and Metallak Point there is a depth of 70 feet.

South Bay has deep water over most of its area and generally close to shore. The greatest depth is 130 feet, almost midway between the shores and directly west of Stony Point, and 120 feet is found farther down the bay, and 100 feet over half a mile from the entrance. The greater depths are found nearer the west than the east shore. The depth of West Bay decreases from about 88 feet off Metallak Point to 79 or 80 feet about three-fourths of a mile farther west, thence rapidly shoals to the outlet.[a]

The fishes found near the lake in the small affluents are considered here as a part of the lake fauna. The following is a list of the species collected by us in these places and in the lake:

Longnose sucker (*Catostomus catostomus*).
Common sucker (*Catostomus commersonii*).
Chub (*Semotilus bullaris*).
Redfin (*Notropis cornutus*).
Longnose dace (*Rhinichthys cataractæ*).
Blacknose dace (*Rhinichthys atronasus*).
Chub-minnow (*Couesius plumbeus*).
Eel (*Anguilla chrisypa*).
Brown trout (*Salmo fario*).
Trout (*Salvelinus fontinalis*).
Blob (*Cottus gracilis*).
Burbot (*Lota maculosa*).

Of these, chubs and chub-minnows appeared to be the most abundant; small blobs were common; cusk and eels doubtless numerous enough; suckers of two kinds plentiful; redfins not numerous, and neither of the two kinds of dace very abundant. It could not be de-

[a] The temperature records of this lake and the other waters examined are given in Mr. Doolittle's section of this report.

termined whether a reputed scarcity of game fishes was real or only apparent. If real, it is impossible to say just what conditions are responsible for it.

There is plenty of deep cool water, and in the small fishes an abundant food supply. During the stay here, however, there was a remarkable scarcity of insects, which might be due to either of two causes, the cold season, which perhaps is not always present, or the fresh westerly winds that blew nearly every day almost with the regularity of trade winds. Calms were very infrequent. Nearly every evening after sunset in pleasant weather there was a light easterly breeze, which continued until morning. Even if the morning was calm, before noon the cool westerly wind would spring up.

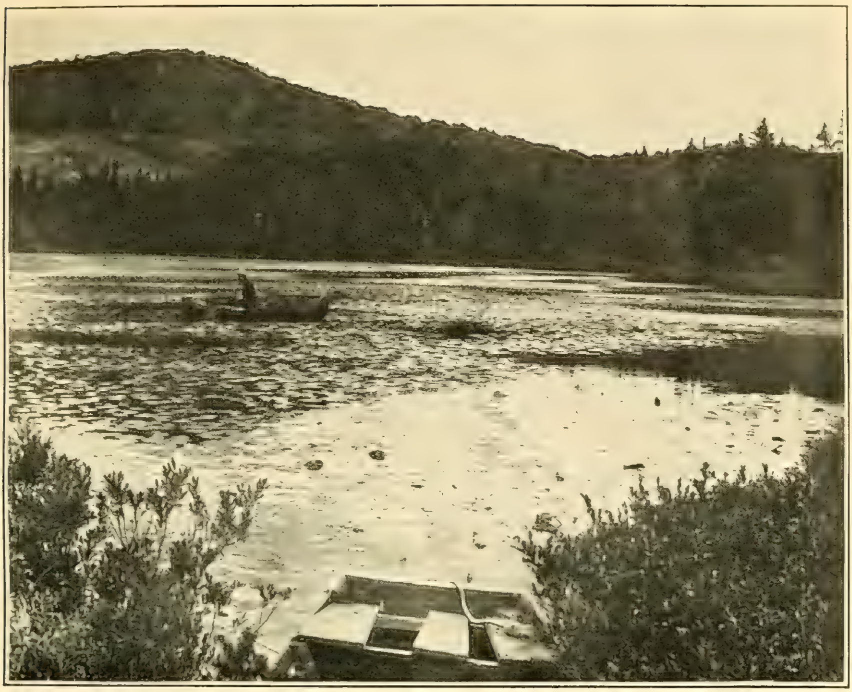
Mud Pond and Brook.—Mud Pond is hardly worthy of notice except that it is the source of Mud Pond Brook, and that, notwithstanding its peculiarly unfavorable character, it contains trout.

The pond is not over 5 or 6 acres in extent and is surrounded by boggy shores in which cranberries, callas, potentilla, pitcherplant, and sweet gale and other shrubs grow. The bottom of the pond consists of oozelike mud, the depth of which could not be found with a 4-foot oar. The water at the time of our visit, July 21, was not much over 1 foot deep. The yellow water lily abounds and there is some pond weed. In places the stout roots of the pond lily were exposed in masses almost sufficient to bear one's weight. It is said that trout are caught in this pond in the spring. We caught mud chub and chub-minnows. In a small spring brook there were many trout from 3 to 7 or 8 inches long. They were very shy, and after a few had been caught no more would bite. The temperature in this brook, which had its source in a nearby springy or boggy place, was 52° F.; at its mouth it was 54° F.; in the pond it was 72° F.

The outlet near the pond was shallow, and even dry in places, or the water ran underground. It was so overgrown with bushes that it could not be explored far from the pond. Where the main road crosses it, about half a mile from First Lake, it is a narrow brook but 2 or 3 feet wide, with here and there comparatively deep pools. In the brook are many small trout (*Salvelinus fontinalis*) up to 8 or 9 inches long, and brown trout (*Salmo fario*) up to 9 inches long. The latter are chiefly in the lower half mile of the brook.

Most of the chub-minnows, suckers, and blobs caught in this brook were found near First Lake.

Round Pond.—It is probably 3 or 4 miles by the connecting brook from Round Pond to First Lake. The pond has an area of about 20 acres, being about one-fifth of a mile in diameter and approximately round, or about as round as " round ponds " usually are. It is nearly surrounded by hills, high enough, perhaps, to be designated by the name of mountains.



MUD POND.

SHORE OF MAIN INLET.

Numerous soundings revealed a maximum depth of about 47 feet. From the middle to the east side there is considerable deep water. Toward the outlet, west shore and north shore, the water shoals, excepting that it deepens somewhat abruptly off the northeast point.

The outlet cove contains a considerable growth of pond weed, and the bottom in shallow water all around the pond bears a profuse growth of pipewort. In the northwest portion there is shallow water and muddy bottom, with a rather luxuriant growth of yellow pond lily. In deep water in many places, even in the middle of the pond, the bottom seems to be covered with a dense growth of fine, green algæ. The pond has no inlets, save some tiny rivulets from near-by spring ground, and it is doubtless fed by subaqueous springs.

The water is cold and, so far as we are able to judge, is well suited to trout, of which, according to popular report, there are many in the pond. Besides trout, there are also numerous chub-minnows, and many water newts (*Diemyctylus viridescens*), which were seen feeding at the surface of the water, swimming up from the bottom, taking insects, and immediately returning to the bottom. They made little wakes at the surface that were at first thought to be caused by some small fish.

Trout are said to be caught near shore when biting well, especially at the south and north ends of the pond. The few caught by us, however, were taken near the middle of the lake in about 25 feet of water.

Main Inlet of First Lake.—This stream is the outflow of Second Lake. It is about 4½ miles in length and for a good part of its course is swift and rocky, but there are some dead waters and deep pools. It has a descent of about 200 feet between First and Second lakes. There are two good-sized tributary streams, Coon Brook and Big Brook, which are now, or were once, good trout streams. Coon Brook is formed by the union of two small branches some 3 or 4 miles, perhaps, from Main Inlet. It is a clear, cool, rocky brook, much overgrown with alders and other bushes, and in many places full of old snags and fallen dead trees.

Big Brook has its source in Unknown Pond and flows southward as a clear, cool, rocky stream to join Main Inlet about 2 miles below Second Lake. It is overgrown with bushes and in places full of old logs like other woods brooks of this region.

Main Inlet affords numerous excellent spawning grounds for the various members of the salmon family. The lower mile or so is still water, with sand and mud bottom and abounding with aquatic plants.

The shores of this dead water are low and muddy or sandy, covered with shore grasses and old stumps. The fishes of the inlet at the season of our visit consisted mainly of suckers, chubs, chub-minnows, and blacknose dace. The dace were most common in quick water; the other species in quiet places, like pools and eddies. Most chubs and suckers were found in the dead water at the lower end of the inlet,

although they were not uncommon in every dead-water pool. Trout when present were always at the mouths of spring inlets, as Coon and Big brooks.

Unknown Pond.—This pond is a tributary of Main Inlet of First Lake through Big Brook. It was not visited in this work, but is said to be an old beaver pond. Descriptions of it given by those who have been there indicate that it has an area of but a few acres and is shallow, but the water is clear and cool. This pond contains trout, some of which are of pretty good size. Some seen by us weighed over 2 pounds each.

Second Lake.—The long axis of Second Lake, lying about north and south, is about $2\frac{3}{8}$ miles long. It varies in width from a half to $1\frac{5}{8}$ miles. The principal affluents are West, Main, Middle, and East inlets, of which Main and East inlets are the largest. The littoral bottom and immediate shores vary considerably in character. Across the head of the lake the water is shallow, the bottom sandy and muddy, and there is an abundant growth of aquatic plants. About the mouths of the inlets the shore is low, producing a growth of shrubs, bluejoint and other grasses. On the eastern shore of the north end of the lake is Hinman Point, a rocky cape forming the southern limit of a large cove. Within this cove there are swampy shores and muddy or sandy bottom. South of Hinman Point much of the shore is a sandy beach interrupted by occasional rocky or swampy places. On this side of the lake the water is shallow for some distance into the lake, the bottom is mostly sand or mud, and there are patches of aquatic plants, especially off the mouths of inflowing streams. At the south and southwest end of the lake, especially in the neighborhood of the outlet, the shores are boggy and swampy, the water is not very deep, about 10 to 20 feet in the deeper portions, the bottom consists of sand and mud, and there is a profuse growth of water plants.

On the west side a point marking the northern limit of the area just mentioned is rocky, and this character obtains for the most part to the north end of the lake. Fairly deep water more closely approaches the shore here than on the east side. Near the north end there is a rocky shoal or reef reaching some distance into the lake.

This lake was found to be shallower in proportion to its size than the neighboring lakes or ponds. A maximum depth of 65 feet was found a short distance off the hill on the southwest shore of the main part of the lake. A channel ran from the head of West Cove, where Main Inlet enters, through this point to the strait leading into South Bay. On the western side of the channel the depth was maintained fairly well to about 150 feet from the shore. Here the depth diminished rapidly to 4 feet at about 30 feet from shore, forming a distinct limnetic bench. On the east side of the channel the bottom was at a general depth of 30 feet, except East Cove, which measured 15 feet deep. South Bay showed a general depth of 10 to 15 feet. The bottom throughout the lake was a deep yellow mud.

EAST INLET OF SECOND LAKE.

EAST INLET OF SECOND LAKE NEAR UPPER END OF DEADWATER.

East Inlet.—Next to Main Inlet this stream is the largest entering Second Lake. The lower 3 miles is mostly swift, rocky, and turbulent. About 3 miles from the lake there is a dam, which has backed the water up 5 or 6 miles, practically making a pond and dead water full of old stumps and dead trees, especially in the lower part. The upper course of the inlet is a characteristic rough and rocky mountain brook. This inlet has been a remarkable trout stream. It is probably fished more than any other stream in the vicinity and hundreds of trout are taken from it every year. Most of the fish are small, however, seldom being over a half-pound in weight.

Other fish observed in the inlet above the dam were chub-minnow and redfin. Below the dam near the mouth of the stream were secured, besides the above-mentioned species, longnose dace and young cusk or burbot.

Main Inlet of Second Lake.—Main Inlet is the outlet of Third Lake. Over most of its course it is a swift, gravelly, and rocky stream. About 1 mile or more of its lower end is dead water, navigable by boats. There are two other dead-water tracts in its course, the lower being about 3 miles from Second Lake. About 2 miles from the lake the inlet is joined by a considerable stream, said to come from Scotts Bog, where excellent trout fishing is found. Main Inlet would be an excellent spawning ground for trout, salmon, and whitefish, although it is more or less obstructed by an old log jam, perhaps 2 miles from Second Lake.

Trout probably resort to this stream to spawn, though it is not now considered a very good trout stream. In the past, however, many were caught there, and the midway dead water was once a favorite spot. At present a good many fine trout are taken in the lower dead water, especially near the mouth of the stream. These fish, however, have doubtless run in from the lake. In August good trout fishing was found just within the mouth of the inlet. In September just outside among the water plants trout and "lakers" were caught. The only other species observed in Main Inlet, excepting just below Third Lake, were chub-minnows.

The fishes collected in Second Lake and inlets are as follows:

Longnose sucker (*Catostomus catostomus*).
Common sucker (*Catostomus commersonii*).
Redfin (*Notropis cornutus*).
Longnose dace (*Rhinichthys cataractæ*).
Blacknose dace (*Rhinichthys atronasus*).
Chub-minnow (*Couesius plumbeus*).
Eel (*Anguilla chrisypa*).
Laker (*Cristivomer namaycush*).
Trout (*Salvelinus fontinalis*).
Blob (*Cottus gracilis*).
Burbot or cusk (*Lota maculosa*).

Third Lake.—This lake was estimated to be about three-fourths of a mile in its longest diameter, which extends about north and south, and about one-fourth mile east and west directly across the middle. There are no large inlets, but several spring brooks enter it at various points. In times of high water these brooks are doubtless much larger, but at the time of this visit they were practically dry in many places or, in some instances, trickling underground. The principal affluent is Main Inlet, entering the southwest corner. The immediate surrounding country is more abruptly hilly or mountainous than that of either of the other lakes.

The lake is very uniformly deep, there being but a narrow shelf of really shallow water except in some small coves like those of Main Inlet and the outlet. In these places there is some aquatic vegetation; off Main Inlet there is a considerable growth of pondweed. Inside of this the bottom on the sandy shelf supports a profuse growth of pipewort. The maximum depth found was 103 feet, and there seemed to be a very general depth of 80 to 100 feet.

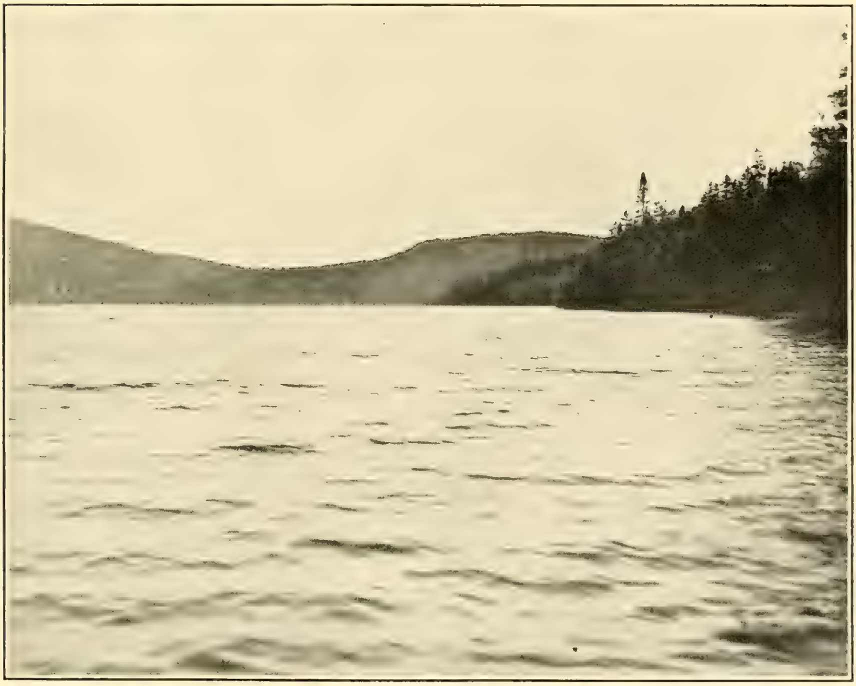
The fishes observed in Third Lake and outlet just below the lake were: Sucker (*C. commersonii*), mud chub, longnose dace, blacknose dace, chub-minnow, and trout. It is said that cusk and eels occur in the lake.

Fourth Lake.—Many have heard of, but few have seen, Fourth Connecticut Lake. Some, claiming to know, maintain that it is at the head of a small brook entering the northwest corner of Third Lake. Others who have seen it affirm that the lake is nothing but a " mud puddle " at the head of Third Lake Main Inlet. Some maps show one good-sized pond at the head of one or the other of these brooks; others represent two ponds, one at the head of each. In order to ascertain the facts, both brooks were explored to their very heads. Main Inlet a short distance from Third Lake is formed by three branches, two of which proceed from spring or swamp ground, the other, the largest and more brook like, from higher ground. Perhaps 2 miles westward of Third Lake the latter brooklet rises in a shallow mud pond, 75 or 80 feet in diameter, and full of aquatic plants. The water is cold, originating in springs. No fishes were found there.

The brook entering the northwest corner of Third Lake was followed until no stream remained to be traced. At perhaps a mile from the lake three small rivulets, swelled by springs, unite to form the brook. Each one of these branches was followed to its last drop of water, but no pond was found.

It is probable that the pool at the head of Main Inlet is the only " Fourth Lake." The inlets of Third Lake are all so small a short distance from the lake that any one of them can be stepped across

SECOND LAKE.



THIRD LAKE

nearly anywhere. The mouth of Main Inlet can be traversed by boat for several rods, but occasional crosswise logs must be hauled over. A few small trout were observed in the inlets for some distance up, or until the streams apparently became unsuitable for fish life.

The following table illustrates the distribution of fishes in the principal waters investigated by us as indicated by our observations:

TABLE SHOWING DISTRIBUTION OF FISHES IN THE LOCALITIES STUDIED.

[NOTE.—Names of introduced species are italicized.]

Name.	Localities.						
	First Lake waters.			Second Lake waters.	Third Lake waters.	Perry Stream.	Indian Stream.
	Lake.	Mud Pond.	Round Pond.				
Catostomus catostomus	×			×		×	
Catostomus commersonii	×			×	×	×	×
Chrosomus erythrogaster							×
Semotilus bullaris	×						×
Semotilus atromaculatus		×			×		×
Leuciscus neogæus							×
Notropis cornutus	×			×			
Rhinichthys cataractæ	×			×	×		×
Rhinichthys atronasus	×			×			×
Couesius plumbeus	×	×	×	×	×		×
Anguilla chrisypa	×			×			
Coregonus quadrilateralis	×						
Coregonus clupeiformis	×			×			
Oncorhynchus tschawytscha	×						
Salmo sebago	×			×	×?		
Salmo fario	×						
Salmo irideus	×			×			
Cristivomer namaycush	×			×			
Salvelinus fontinalis	×	×	×	×	×	×	×
Osmerus mordax	×						
Esox reticulatus							
Cottus gracilis	×	×		×		×	×
Lota maculosa	×			×	×		×

LOCAL GEOGRAPHIC RELATIONSHIPS OF THE FISH FAUNA.

NATIVE SPECIES.

The geographic position of these waters would indicate a close faunal relationship to Vermont, Maine, and the neighboring Canadian territory. In fact, some of the tributaries of the upper Connecticut River and probably of Third Lake rise within the Canadian border, and many of them are not far remote from tributaries of the St. Lawrence River, but doubtless there are topographical limits to the intermingling of fishes of these regions. The fish fauna of Connecticut Lakes is markedly different from neighboring Maine waters, the Megalloway River, Parmachenee and Rangeley lakes. It is closer to Vermont, especially Memphremagog Lake, and accordingly to the St. Lawrence basin.

Of the 16 native species of fishes now known to occur in the Connecticut Lakes and tributaries of the upper Connecticut River above Pittsburg, 15 species were collected on this expedition. Of these the

longnose dace (*Rhinichythys cataractæ*) had not before been recorded from any locality as far east as New Hampshire. The red-bellied minnow (*Chrosomus erythrogaster*) and bronze minnow (*Leuciscus neogæus*) are also new records for New Hampshire, and their occurrence here helps to fill the gap between Maine and the more western localities of their range.

Although the chub-minnow (*Couesius, plumbeus*), brook chub (*Semotilus atromaculatus*), and longnosed sucker (*Catostomus catostomus*) are well known to the inhabitants of this region, we know of no records of their occurrence in New Hampshire, but they were to be expected, since they have been collected in neighboring localities in Maine and Vermont. Of particular interest is the collection of young cusk (*Lota maculosa*), which, so far as we know, have not hitherto been collected in North America.

Species not found by us, but to be expected to occur in this region, are the shiner (*Abramis crysoleucas*) and possibly the Labrador whitefish (*Coregonus labradoricus*).

The following table shows, in parallel columns, the faunal similarity, as exhibited by our collections, of northern Vermont and the upper Androscoggin River and Rangeley Lakes, Maine, with the upper Connecticut River in northern New Hampshire. A cross mark opposite the names of upper Connecticut fishes indicates their presence in the regions represented in the respective columns.

Names of upper Connecticut fishes.	Northern Vermont and Memphremagog Lake.	Upper Androscoggin waters, including Rangeley Lakes.
Catostomus commersonii	×	×
Catostomus catostomus	×	×
Chrosomus erythrogaster	....	....
Semotilus bullaris	×	×
Semotilus atromaculatus	×	×
Leuciscus neogæus	....	×
Notropis cornutus	×	×
Rhinichthys cataractæ	×	....
Rhinichthys atronasus	×	×
Couesius plumbeus	×	×
Anguilla chrisypa	×	×
Coregonus quadrilateralis	....	....
Cristivomer namaycush	×	....
Salvelinus fontinalis	×	×
Cottus gracilis	×	×
Lota maculosa	×	....

INTRODUCED SPECIES.

From New Hampshire Fish and Game Commission and United States Fish Commission reports, and from letters from the state commissioners and superintendents of hatcheries in New Hampshire, has been compiled a fairly complete account of the artificial or fish-

cultural distribution of fishes in New Hampshire. It is found that the following species have been planted in the Connecticut Lakes:

Whitefish (*Coregonus clupeiformis*).
Quinnat, or chinook, salmon (*Oncorhynchus tschawytscha*).
Landlocked salmon (*Salmo sebago*).
Rainbow trout (*Salmo irideus*).
"German brown trout" (*Salmo fario*).
"Mackinaw," or "Lake," trout (*Cristivomer namaycush*).
Brook trout (*Salvelinus fontinalis.*)
Smelt (*Osmerus mordax*).

Of these the brook trout and the lake trout are native, as of course is known. The dates of introduction of the other species and number planted will be found under the respective species in the list.

New Hampshire was the first of the states to undertake fish propagation and distribution. The enterprise was taken up with great enthusiasm, and notwithstanding the fact that the state fish commission has been more or less hampered by lack of funds, a vast quantity of young fish have been propagated and introduced into New Hampshire waters. In the early enthusiastic distribution of fish, however, which was somewhat indiscriminate, species were introduced where they should not have been, with occasional disastrous results, the cause of which was not always apparent. Such results may be of at least two kinds: First, to the introduced fry themselves, and, second, to the native fish. Fish introduced into unsuitable waters will, of course, not long survive, and to plant pike, pike perch, or black bass in trout ponds is hazardous. It may be added, too, that caution should be used in planting salmon and lake trout unless they are preferred to other trout already in the waters.

It is a prevalent opinion that since smelts survive, thrive, and increase so prolifically in almost every body of water into which they are introduced, angling is detrimentally affected thereby, for the smelts afford the game fish so much food that the latter do not get hungry enough to take a hook. This is disputed by others, however, who claim that game fishes when feeding will take the hook readily no matter how abundant the food is. In our experience the latter seems to be the case, provided the right kind of lure is used and the fish are there. This suggests the question often asked, "What has become of all the fish planted?" and of the native fish, too, for that matter.

It must be recognized that there are many ways by which lakes and streams become depleted. Logging operations are destructive to fish life in several ways, such as shutting the fish from spawning grounds, destroying young fish by log driving, and by winter fishing to supply the camps with food; and there are but few waters that have not felt the effects of excessive fishing before protective laws were enacted, and from poaching afterwards. Nets, spears, and giant

powder are not unknown to many northern waters to-day, where the highly esteemed trout, laker, and whitefish abide. It is not a case of sport with those who employ such means to take fish, but a matter of food, and often, too, to those greatly in need of food. These are a few of the factors operating toward the disappearance of native food and game fishes.

Sometimes the reason that introduced fish are never again observed is that the waters are unsuited to them. The water may be too cold or too warm; there may be too many enemies; they may have been all devoured by predaceous fishes that have invaded the waters. In fact it is no unknown occurrence in planting fry to turn them almost into the mouths of chubs and cusk. This sometimes occurs from carelessness, but more often from ignorance of the habits and needs of the young fish. Another reason that introduced fish have not been recorded from waters into which they have been planted is that they often resemble native forms so closely that they have not been recognized when caught, or perhaps they have never been caught, not having been fished for at the proper season of the year and in the right way. Still another reason is that in a large body of water a few survivors of a comparatively few introduced young may escape detection for a long time. All of these things may apply in greater or less degree to the Connecticut Lakes.

Inhabitants of the neighboring country have but a vague idea regarding the nature or appearance of introduced fishes. They are not familiar with the fact that the "Mackinaw trout" is identical with the "laker" or "lunge" native to the lakes; of course the "Mackinaw trout" is never caught, only "lunge," unless it should be in the manner instanced by a resident of this country who having secured 3 fish strange to him thought he had the "Mackinaw trout" because they were different in appearance from anything he had ever seen or read of. His description revealed that he had males of the landlocked salmon. Another instance is of some "trout" caught by a sportsman at Metallak Lodge in a neighboring brook. Persons who had seen young landlocked salmon maintained that the fish were such. They were in fact young "brown trout" (*Salmo fario*). It is not to be wondered at, however, that they were mistaken for salmon, for the resemblance is very close.

It remains, then, to be said that in our opinion, if it is desired to stock the Connecticut Lakes or any one of them with such species as have been introduced, the result can not be accomplished by an occasional plant of a few thousand fry or fingerlings. Many thousand fry or young should be planted every year for several years. Again, the fish should be placed in waters where they will be least likely to be reached by those fishes that would surely devour them, i. e., chub, eels, cusk, etc., and even their own kind if present are not averse to

cannibalism. The best places to plant fry or fingerlings are in the smaller spring brooks flowing into the lakes or streams. It is unnecessary to say that the brooks should be protected so far as possible. To be more specific, it is suggested that Coon Brook would be an excellent place in which to plant young fish in stocking First Connecticut Lake. West Inlet and Moose Brook would be admirable localities connected with Second Lake. There are no very choice tributary streams of Third Lake, but possibly two little brooks entering the north end would prove satisfactory. The so-called "Main Inlet" in the southwest corner seems wholly unsuitable.

THE FISHES AND THEIR HABITS.

As previously noted, there are but few native species known in these waters. Regarding these, however, there are a few peculiarities worthy of mention. The small size attained by the individuals of some of the species in First and Second lakes is striking, particularly of the long-nosed sucker (*Catostomus catostomus*), chub-minnow (*Couesius plumbeus*), and blob (*Cottus gracilis*). In Vermont the sucker attains a large size, an individual in our collection from Caspian Lake measuring 15 inches in length; specimens from First and Second lakes average 4.62 inches in length, ranging from 3.75 to 5.12 inches. This is especially noticeable, since the other sucker (*C. commersonii*) reaches a much larger size, our collection containing specimens ranging from an inch to a little over 16.25 inches long. The chub minnow is a dwarf compared with specimens from Vermont and northern Maine, Vermont specimens ranging from 4.18 to 4.62 inches long, and northern Maine up to 6 inches in length. In Round Pond and Third Lake, however, this species is considerably larger than in First and Second lakes, specimens measuring a little over 5 inches in length. The blob, or sculpin, in all the localities where it was collected was very small, the largest, a specimen from Mud Pond Brook, measuring less than 3 inches in length, while from the Aroostook River in Maine we have specimens nearly 5 inches, and from a tributary of the Androscoggin River specimens reaching a length of 4 inches. We can offer no suggestion regarding the cause of the diminutiveness of these fishes in First and Second lakes, as most of them seem plump and healthy, though many of the suckers and chub minnows are affected with tapeworms. In some instances the stomach and intestine are so full of them that the abdominal cavity is greatly distended. The question of food supply is one of the first to suggest itself, but there is no evidence that there is more food in Round Pond and Third Lake than in the others mentioned. The result of the study of the plankton and stomach contents of these fishes may throw some light on the subject.

KEY TO SPECIES.

The following key, although not wholly satisfactory, will be found helpful in identifying the species included in the following list. It is arranged on the alternative plan, and is to be used in the following manner:

Trace the characters of the specimens with what is said under each succeeding letter, until there is a disagreement, or the name of the fish is reached. When a disparity occurs, go to the double of the letter under which it occurs, thence proceed as before until another disagreement or a name is found, and so on.

Example: We have, say, the brown trout and it is not recognized. Compare it with statement *a*. It does not agree, having 2 fins on the back. Turn to *aa*. Two fins on the back agrees; go then to *m*, where the statement also agrees. *n* agrees also; *o* does not; but *oo* does; likewise *p* and *q*. *r* does not, since the outer ventral rays of our specimen are white, and the red spots are surrounded with a light blue areola.

Turn to *rr*, which agrees. The presence of red spots places it in *t*, with which it agrees, and the name follows.

a. One fin on the back.
  b. Ventrals or belly fins present; body not especially elongate, vertical fins (dorsal and anal) not meeting around the tail.
    c. Lips thick, provided with small rounded elevations or papillæ.
      d. Snout long; scales comparatively small, about 104__LONGNOSE SUCKER.
      dd. Snout not very long; scales larger, about 67_______COMMON SUCKER.
    cc. Lips not especially thick and without papillæ.
      e. Scales very small and inconspicuous.
        f. Lateral line, or line of pores along side, incomplete; mouth terminal, oblique.
          g. Two dark stripes along side______________REDBELLIED MINNOW.
          gg. One dark stripe along side_________________BRONZE MINNOW.
        ff. Lateral line complete; mouth somewhat inferior and horizontal.
          h. Snout long and prominent, projecting notably beyond the mouth; dark stripe along side if present not especially distinct___________________________________LONGNOSE DACE.
          hh. Snout moderate, projecting but little beyond mouth; a distinct black lateral stripe___________BLACKNOSE DACE.
      ee. Scales larger and conspicuous.
          i. Mouth large, with bands of sharp teeth; dorsal or back fin situated posteriorly___________________________PICKEREL.
          ii. Mouth not especially large; no teeth; back fin not placed posteriorly.
            j. Breast or forward paired fins (pectorals) not reaching nearly to ventrals.
              k. No black spot at base of dorsal fin in front; scales not small and not crowded on front part of body__CHUB.
              kk. Black spot at base of dorsal in front; scales smaller and crowded on fore part of body______MUD CHUB.

jj. Pectorals reaching nearly to ventrals.

l. Scales on side deeper than long............REDFIN.

ll. Scales on side not deeper than long..CHUB MINNOW.

bb. Ventrals wanting; body very elongated and vertical fins meeting around the tail..EEL.

aa. Two fins on back.

m. Smaller fin posterior to the larger one and without rays or spines (adipose).

n. Mouth large, provided with strong sharp teeth on jaws and tongue.

o. Anal fin with more than 12 rays (14 to 17). CHINOOK SALMON.

oo. Anal with not more than 12 rays (9 to 12).

p. Body spotted.

q. Body with dark colored or black spots; with or without red spots.

r. Pectorals and ventrals without white outer rays; no red spots on side in adult; in young red spots when present not surrounded by another color (not ocellate).

s. No dark spots on tail; no broad rosy or reddish stripe along side; spots on tail, when present, yellowish or orange.......LANDLOCKED SALMON.

ss. Dark spots on tail; usually a broad rosy or crimson stripe along side. RAINBOW TROUT.

rr. Pectorals and ventrals with outer rays white; sides usually with red spots.

t. Back without wavy markings (rivulations or vermiculations) but spotted with rather large dark colored spots.......BROWN TROUT.

tt. Back not spotted, but with rivulation or vermiculations.....TROUT.

qq. Body with light-colored spots, no red spots....................LAKE TROUT.

pp. Body not spotted, but plain dusky, olivaceous, greenish or silvery..........SMELT.

nn. Mouth small, with no teeth in jaws or tongue, except sometimes fine bristle-like teeth (asperities).

u. Body spindle-shape (fusiform) not compressed; snout compressed and pointed, not blunt and flattened at the end (not truncate); ventral sometimes reddish.....ROUND WHITEFISH.

uu. Body somewhat compressed and deep; snout not compressed and sharp, but truncate; ventrals never reddish. WHITEFISH.

mm. Smaller back fin anterior to the larger one and provided with weak spines or rays.
v. Body not especially elongate; no barbel at chin; ventrals with 3 or 4 rays each__Blob.
vv. Body elongate; barbel at chin; ventrals with 7 rays each. Burbot.

1. Longnose Sucker. *Catostomus catostomus* (Forster).

Head 4.2 (3.7 to 4.7); eye 5 (4.4 to 5.75); snout 2.25; interorbital 2.2 (1.75 to 2.6); dorsal 10; anal 7; longest dorsal ray 1.4 (1.3 to 1.6) in head; longest anal ray 1.5 (1.45 to 1.85); longest pectoral ray 1.3 (1.18 to 1.44); longest ventral 1.75 (1.7 to 2); scales about 18–104–12.

Body elongate, round and tapering; head long and slender, depressed and flattened above, broad at base, tapering into the long snout which overhangs mouth; lips thick, papillæ in 2 or 3 rows in front, usually 4, sometimes 3 on side; eye moderate, slightly behind middle of head; origin of dorsal midway between tip of snout and base of caudal; lateral line much broken; peritoneum black.

Brownish olive with lower parts white; back and sides with golden or bronze reflections or plain, frequently mottled or clouded with darker, the mottling often assuming the form of irregular cross bars. In breeding males there is often a rosy lateral stripe.

Distinguished from the other sucker by having a longer head and nose and finer scales. Specimens from First Connecticut Lake range in length from 3.75 to 5.37 inches, with an average of about 4.62 inches.

This northern sucker was described from Vermont by Le Sueur as *Catostomus longirostris*. Forster first records it from Canada as *Cyprinus catostomus*. It is sometimes called "red sucker" and "red-sided sucker," owing to the red or reddish stripe that is frequently present along the side in the breeding season. It is also known as "small scale sucker." It is found from New Brunswick and New England westward to the Great Lakes, and northwestward to Alaska. We collected it in Indian Stream, Perry Stream, streams connected with First Connecticut Lake, and in Second Lake. The largest specimens were found in Perry Stream.

This species is regarded as a comparatively deep-water fish, seldom entering shallow water except to breed or feed upon the eggs of other fishes. In many waters it attains a much larger size than it does here. There seem to be two distinct sizes of adult fish. The small one was described by Mather [a] as *Catostomus nanomyzon*. The food of this

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[a] Mather, Fred. Memoranda relating to Adirondack fishes, with descriptions of new species, from researches made in 1882. Twelfth Report Adirondack Survey, Appendix, Zoology, 1886, p. 36.

sucker consists mostly of small animal and vegetable life which it gathers at the bottom, but it has been seen to take insects at the surface and it doubtless will eat young fish. It is known to devour fish eggs. In Perry Stream it was found quite eager for a baited hook and several were caught in that way. The stomach contents of the specimens collected consisted of a considerable quantity of fine algæ, entomostraca, and larval insects. Many larvæ of a black fly were observed; very fine sand was also present. Some specimens were found with stomachs full of fish eggs, presumably of *Couesius*.

The breeding season is in June and July in this region. We found some examples with eggs and milt, but most of them had already spawned by the 1st of July. This species ascends brooks to spawn, at which time the males have small hard tubercles or excrescences on the hinder portion of the body and larger ones on the anal fin and lower half of the caudal. The fish is perhaps too dark to be useful for bait unless it be cut bait. It is most easily caught in quantities in a wire minnow trap or a seine.

2. Sucker. *Catostomus commersonii* (Lacépède).

Head 4.1; depth 5.5; eye 5.2; snout 2; dorsal 12; anal 7; longest dorsal ray 1.56 in head; longest anal 1.3; longest pectoral 1.3; longest ventral 1.85; scales 12–67–7, crowded and much smaller anteriorly.

Body moderately stout, varying with age, subterete, heavy at the shoulders; head rather large and stout; snout blunt, lips strongly papillose, upper not greatly overhanging lower, with 2 or 3 rows of papillæ; eye moderate, high, slightly behind middle of head; origin of dorsal midway between tip of snout and base of caudal; anterior rays of dorsal and anal longest, tip of latter reaching base of caudal; tips of dorsal and ventrals when depressed reaching the same vertical line posteriorly; caudal forked; ventrals not nearly reaching vent; pectoral broadly falcate; lateral line complete, not broken.

Color dusky above, especially on margins of scales; head dusky to upper margin of upper lip and in line shortly below eye to gill-opening, abruptly white below; dark of body beginning just above pectoral and extending in almost straight line to lower base of caudal; pectorals and ventrals pale below, somewhat dusky above; anal pale, dorsal and caudal a little darker than other fins but not so dark as body. The young of this species are somewhat differently colored from the adults: Top of head and upper part of side of head and upper part of body light olive, mottled and clouded with darker brownish olive; mottling most intense on edges of scales; arranged in irregular and indefinite cross bars on back and side; the first bar on nape just back of occiput, second just in advance of dorsal, third at posterior base of dorsal, fourth about midway the space between base of dorsal and base of caudal, fifth on base of caudal, all becoming spotlike, irregular and indefinite on side, but of somewhat darker shade near lateral line; lower parts almost abruptly paler or white; fins all pale; color from a specimen 3.12 inches long. Smaller fish have about the same general color, but the markings are more distinct and definite.

Distinguished from the longnose species by the shorter, heavier head and larger scales.

This sucker derives many of its local names from its color, appearance and habitat, being variously known as "black sucker," "white sucker," "brassy sucker," "barvel," "barbel," "brook sucker," and "lake sucker." In North America it has an extensive range, being recorded as follows: Quebec, Nova Scotia, New Brunswick, and the Great Lakes, south to Georgia and Missouri, west to Colorado and Montana, and northward to Ungava Bay.

It is the larger of the two suckers occurring in the Connecticut lakes; we have one specimen from Second Lake measuring 16.20 inches in total length. It occurs in all of the waters of this region. It inhabits all kinds of waters from large lakes to small ponds and great rivers to rivulets, and of course varies correspondingly in appearance and size. Its food is usually minute animal and vegetable organisms, though it does not reject larger objects. Young fish have been found in its stomach and it feeds largely upon the eggs of other fish when it can get them. Young fish 1.37 to 1.62 inches long from Indian Stream, August 4, were found to be feeding upon diatoms, desmids, and black fly larvæ. It will frequently take a baited hook, and sometimes is so eager for the bait that it causes annoyance to anglers. It has been caught on a spoon and on the artificial fly, but rarely (only once in our experience). When hooked a large sucker fights vigorously for a short time, then succumbs.

So far as known it is of little use to any water of which it is a denizen, unless it be by eating larval insects. As a food fish it is not of much value, though it is eaten and is said to be of good flavor when taken from cold waters, but rather bony.

Young suckers have not very often been found in other fishes' stomachs, though occasionally a cusk contains one or more. A guide at Second Connecticut Lake informed us that when they were allowed to use "night lines" sucker bait was considered the best for "lunge."

This sucker ascends streams in the spring and early summer to spawn, when in some places it is caught in large quantities with spear or dip net to feed the hogs and fowl, or to use as fertilizer. It usually runs at night, sometimes returning to the lake before daylight, sometimes hiding away during the daytime in deep holes, under banks, or overhanging bushes. The spawning season in Connecticut Lake water had passed before July 1. Like the other species mentioned, adults of this species only a few inches long also occur in small bodies of water, and one of this character was described by Mather as *Catostomus utawana*. But, unlike the longnose sucker, the size varies with the size of the stream or lake in which it occurs.

3. Red-bellied Minnow. *Chrosomus erythrogaster* Rafinesque.

Head 4; depth 4 (4.2 to 5); eye 3.5; snout 3.8; dorsal 8; anal 8; scales 18–80 to 85–10; teeth 5–5. Body moderately elongate and thick, slightly compressed; head small, conical; snout slightly pointed; mouth moderate, terminal, oblique, the jaws about equal; maxillary reaching nearly to front of eye; eye large, in anterior part of head; lateral line usually ending before reaching as far as vent; origin of dorsal over space between vent and ventral origin, also midway between tip of snout and tip of rays in fork of caudal; caudal forked; anterior base of anal under posterior base of dorsal; ventrals reaching to vent; pectoral not nearly reaching origin of ventrals.

Light olive on top of head and back; cheeks dusky; paler on sides; belly white; black line from nape to base of dorsal, splitting and passing along base of the fin on each side, reuniting behind and continuing to upper base of caudal; dusky stripe from upper posterior part of eye along side, breaking up into spots under dorsal fin, spots continuing nearly to caudal; another broader black stripe from snout through eye to base of caudal, where in small individuals it ends in a small distinct spot; fins and lower parts all pale. In the breeding season the male has the lower fins and belly bright lemon-yellow and sometimes red between the two lateral stripes.

The only fish with which this species is likely to be confounded is *Leuciscus neogœus*, small individuals of which strikingly resemble it. The most prominent external mark of separation is the broken upper lateral stripe and small mouth of the red-bellied minnow. Of internal differences, this species has the lower pharyngeal teeth in one row, and possesses a long intestine, while the other has teeth in two rows and a short intestine.

The only common name for this fish, so far as known to us, is the one given above. The distribution of the species has been given as from New York to the Dakotas and Tennessee. It is common in Maine, and the discovery of it in this region helps to fill the gap between Maine and New York. We found it to be abundant in pools in a meadow or field near Indian Stream on August 4. It is one of the smallest of the minnow family, probably not attaining a length of much over 2 inches. Its long intestine indicates that it is mainly a vegetarian. The stomach and intestines of those examined by us contained mostly diatoms and some larval black flies. The breeding habits of the red-bellied minnow in this region were not observed by us, but in Freeport, Me., it was found spawning in June. It doubtless serves as food for the other fishes. It makes an attractive aquarium fish.

4. Chub. *Semotilus bullaris* (Rafinesque).

Head 4; depth 4; eye 7 (much larger in smaller examples); snout 2.6; maxillary 2.6; mandible 2.6; teeth 2, 4–5, 1; dorsal 8; anal 8; longest dorsal ray 1.3 in head; longest anal 1.75; longest pectoral 1.3; scales 8–51–6.

Body moderately deep, elongate, compressed; caudal peduncle deep; head large; snout rather bluntly conic; mouth large, terminal, somewhat oblique; upper jaw slightly longer; maxillary not quite reaching anterior edge of orbit; eye large in small examples, small in large ones, high up and anterior; origin of dorsal slightly nearer base of caudal than tip of snout, over sixteenth or seventeenth scale of lateral line, edge of fin in a straight line; caudal deeply

forked; anal similar to dorsal, but smaller; origin of ventral under origin of dorsal, fin not reaching vent; pectoral small, broadly falcate, reaching slightly more than half distance from its posterior base to ventral; lateral line curving abruptly downward over anterior part of pectoral, straight for rest of its course. Description from a specimen 13 inches long from First Connecticut Lake.

Back olive; cheek purplish and brassy; side with brassy or golden reflection; posterior margin of scales black; dorsal and caudal dusky, other fins pale.

Other names by which this widely distributed fish is known are fallfish, windfish, dace, silver dace, and chevin. It occurs commonly in eastern Canada and the United States east of the Alleghenies as far south as Virginia. Its size varies greatly in different waters and in the same waters, but becomes larger northward than in the south. In small streams and ponds it is correspondingly smaller, and in small brooks it reaches maturity when only a few inches long. The chub was common in First Connecticut Lake and the Main Inlet, Perry and Indian streams. It was not obtained in Second or Third Lake or in Round or Mud Pond. In First Lake it could be caught at any time at the mouth of the sewer leading from the lodge, and usually from the wharf. The largest size, however, was not found here, but out in the lake and in the dead water of the inlet large ones were common. They were taken in the lake by trolling; in the inlet on a fly and by gill-net. A gill-net set one night across the inlet took 18 chubs and 19 suckers.

The variation in appearance of the chub at all seasons is almost as great as the variation in size, and in breeding season the sexes differ much in color and somewhat in other respects. Little adult fish resemble young of larger ones, being silvery, and having a dark stripe along the sides. Larger fish are silvery with the stripe showing but faintly or not at all, and still larger ones show no stripe and have dusky posterior exposed margins to the scales. The largest individuals have sexual and age variations, but in general it may be said that in these the colors are more evident and pronounced, the head being black, purple, and blue, yellow with golden and bronze reflections; back olive green; sides purplish or bronze; belly yellowish silvery, or white; posterior margins on lateral scales black. The metallic luster and iridescence is beyond graphic description and the artist's brush can but inadequately represent the varying hues and reflections.

The chub is almost omnivorous, eating everything that a trout will eat and much that the trout will not; if there are sewers or drains entering a lake or stream it will always congregate about the mouths. It will bite more readily than the trout, but is, however, sometimes wary and capricious. Hot sunshiny days are unfavorable for catching large chubs. Small chubs usually take the hook more readily than large ones. As a game or food fish the chub

A CHUB'S NEST.

is not highly esteemed. When hooked it fights well for some time, but yields somewhat more quickly than a trout. It will take bait, troll, or fly. Brown or red flies are most attractive. That it is not esteemed as food is due rather to lack of flavor than to a disagreeable taste, and also because other more delectable fish usually occur where the chub is caught. Thoreau says the "chub tastes like brown paper salted."

The breeding habits of the chub are very interesting. Along the quiet reaches of streams or in the shallow waters of ponds or lakes, peculiar heaps of fine gravel or pebbles have probably been noticed by everyone traversing such places. These are the "nests" of chubs. Our attention was first called to this by notes furnished by Supt. Charles G. Atkins, of the United States Bureau of Fisheries Station at Craig Brook, Me., who very carefully recorded the nest-building and spawning process, which description, so closely agreeing with our subsequent observations, is given herewith, as is also a diagrammatic illustration (pl. v).

May 8, 1878.—A small male was seen standing over a hole at the lower end of a heap of gravel 3 feet long by a foot wide, repeatedly driving off other chubs. Later a large male came and drove away the little one, henceforth taking charge of the nest. He was very vigilant, dashing immediately and furiously at every approaching fish, just as landlocked salmon do. After a time he took a pebble in his mouth from *c* and carried it to *d*, where he dropped it. By and by a female came swiftly along, and right over *cd* was seen struggling in an erect position; the male was close to her, but nothing more could be made out. Then the female disappeared. No other fish than this one male remained over the nest.

May 9, 1878.—The same large male was on the nest, but near him over the nest is another small one, which the large one did not this time molest, and which appeared to be a male. The small one was seen to chase others, and when the large one was absent, picked up stones, placing them on the heap; but none of those that appeared to be females lifted a stone. At another time the large male carried stones from about *a* and dropped them at *c* or *d*. His regular stand was over *b;* sometimes he would pick up stones at *c* or *c'* and carry then up to *c'* or *d;* the little one doing the same thing, but sometimes he would carry a stone no more than 2 inches upstream. Several times the large one went up to *g* and returned with stones to *d*. During the observations he was seen to make 15 or 20 trips to a gravel bed 6 or 8 feet distant on the opposite side of the brook and take stones from it and return to his nest. Sometimes he would have but one stone, sometimes several small ones, and rarely a mouth full of very fine gravel mixed with sand. Once he took a stick 3 or 4 inches long and laid it on his nest. He seemed often to eject the burden from his mouth with considerable force; but this appearance may have been from his recoiling the moment he let go the stones. The females, as they were supposed to be, came to the nest several times. In general there was a sudden gathering of a number of fish from the immediate neighborhood, comprising all the chubs within 5 or 6 feet or more, and a simultaneous rush for the nest, where only a confused mass of struggling fish could be distinguished; some of them turned over so that the gleam of the side of their bellies was seen. The old male was always there.

In this region when these investigations were begun, the chub was through spawning, but heaps of pebbles, some of them containing at least a bushel, were seen in various places along Indian Stream and Main Inlet of First Lake.

5. Mud Chub. *Semotilus atromaculatus* (Mitchill).

Head, 3.7; depth, 4.1; eye 5; snout 2.85; maxiliary 2.5; mandble 2.85; teeth 2, 5–4, 2; longest dorsal fin 1.42; longest anal 1.66; longest pectoral 1.66; scales 10–55–5.

Body stout, dorsal outline slightly arched in front of dorsal, body tapering backward from a point considerably in advance of dorsal; head somewhat thicker than body, short, with an obtuse and moderately declivous snout, the later rather bluntly rounded; mouth broad, oblique, lower jaw slightly included; upper jaw just below lower level of pupil; maxillary not quite reaching front of eye; eye small, high up; scales small, much crowded anteriorly, about 30 in front of dorsal; origin of dorsal over twenty-seventh scale of lateral line; origin of anal slightly in advance of this, under twenty-fourth scale; dorsal and anal similar, the edges forming a straight line; caudal forked; ventrals small, not reaching vent; pectoral small, broadly falcate, reaching slightly more than half the distance from its posterior base to ventral fin; lateral line abruptly bent downward to tip of pectoral, thence straight and nearly median to base of caudal.

Top of head and snout dull steel-blue, cheeks and opercles pale, dusted or sprinkled with olive, back and side olive, with dark margins to scales, most intense and broader posteriorly; side of head, lower jaw, throat, sides of body below lateral line, and belly white or creamy, with dusky or dark grayish margins on scales, same as those above lateral line; scales thus marked extending nearly to level of pectoral, ventral and anal fins; these fins pale with dusky rays; dorsal olive, with jet black spot at base in front; caudal olive, with darker rays; a dark lateral stripe from cheek along side, at first on, then just above, finally on, lateral line to caudal; shoulder girdle just under posterior margin of gillcovers black; a narrow jet black stripe along back from nape, passing each side of base of dorsal to upper base of caudal.

Distinguished from the other chub by darker coloration, scales more crowded anteriorly, and the black dorsal spot; from all other cyprinids in this region by dorsal spot.

This chub bears many local names, but the only one heard in this region is mud chub. The mud chub does not attain so large a size as the common chub, in New England reaching a length of not over 10 inches so far as known, but averaging considerably smaller. The specimens in our collection run from 2.5 to 5.75 inches in length. The recorded range of this species is Maine to southern Missouri, Wyoming, and Canada. In the upper Connecticut region it was collected in Indian Stream, Mud Pond, and outlet of Third Lake just below the lake. It was not found in First Lake, in Main Inlet of First Lake, in Second Lake, or in East Inlet.

The habitat of this species differs in some respects from the common chub, more often being found in brooks and streams, especially in quiet "weedy" places and muddy ponds, yet both not uncommonly occur together.

The mud chub spawns in early summer, at which time the body of the male becomes of a darker hue and the pectoral and ventral fins are often of a bright orange color, and there are horny excrescences on the snout and top of head. This chub readily takes a hook baited with worm, piece of fish, or any kind of flesh, and frequently an artificial fly.

6. Bronze Minnow. *Leuciscus neogæus* (Cope).

Head 4.11 (3.83 to 4.18) in length without caudal; depth 5 (4.60 to 5.50); eye 4 (4 to 4.50) in head; snout 4 (3.55 to 4.50); dorsal 8; anal 8; scales 85 (82 to 90).

Head rather short, broad, and blunt; snout short, equaling eye; eye large; mouth large, very oblique, maxillary reaching to nearly below front of pupil, jaws even; teeth 1, 5-5, 2. Body stout and chubby; origin of dorsal much nearer base of caudal than tip of snout; scales very small; lateral line of about 17 pores, not reaching a point above insertion of ventrals; dorsal rounded, the middle rays longest; pectoral and ventral pointed; caudal deeply forked.

The above description is taken from a specimen 3.33 inches in length and from 8 other specimens collected in pools in a field near Indian Stream August 4. These 8 were the largest of many collected; they range from about 2 to 3.50 inches long, and are all females. The pharyngeal teeth are uniformly 5 in the main row and 1 or 2 in the other.

Top of head, snout, and back brownish olive with sharply defined edge from upper border of eye to upper base of caudal; a stripe from eye along axis of body to base of caudal, terminating in a small distinct black spot; the area between the dark of the back and the lateral stripe presenting the appearance of a broad lighter stripe from upper posterior border of eye to upper base of caudal; a narrow stripe from nape along median line of back, passing each side of base of dorsal, reuniting behind and continuing to upper base of caudal; entire lower part of body from tip of lower jaw to base of caudal pale; fins all dusky; entire fish with a brassy or bronze luster, whence the name bronze minnow. Males often with red along the side.

Distinguished from the red-bellied minnow, the only fish in this region with which it could be confounded, externally by the larger mouth and the arrangement of stripes. In some specimens the sides of back may be somewhat lighter than at the margin of the dark color, giving the appearance of a second dark stripe bordering the lighter area above the lateral stripe. This is less distinct than in the other species, and if broken up into spots at all it is so broken anteriorly, instead of posteriorly as in *Chrosomus*. This stripe-like appearance usually terminates or blends with the dark color of the caudal peduncle before reaching the base of the caudal fin. Internally this species has well-marked diagnostic characters, having a much shorter alimentary tract and 2 rows of pharyngeal teeth.

In our opinion the generic name *Phoxinus* should be retained for this minutely scaled fish, differing so markedly in this and other respects from other species designated as *Leuciscus*. There is a greater difference between the subgenus *Phoxinus* and other members of the genus *Leuciscus* than there is between *Leuciscus* as a whole (leaving out *Phoxinus*) and *Semotilus*.

The bronze minnow feeds upon small insects, eggs, larvæ, worms, and vegetable matter. The stomachs of some examined contained large amounts of fine algæ. It seems to prefer water characterized

by the same conditions as are sought by *Chrosomus*, at least they frequently occur together. The only locality in this region in which it was found was in the meadow-spring holes along Indian Stream. That it occurs in other places is likely. It is an attractive bait, and doubtless furnishes food for other species. Its spawning time is in early summer, but its habits have not been observed. It is believed that this is the first time that it has been collected east of Michigan except in a few places in northern Maine and in New Brunswick. It is a handsome minnow, attaining a larger size, about 4 inches, but closely resembling *Chrosomus* in color, and will readily take a hook baited with worm.

7. Redfin. *Notropis cornutus* (Mitchill).

Head 4.12 in length without caudal; depth 4.34; eye 4.80 in head; snout 3; dorsal 8; anal 9; scales 8–44–3.

Head of moderate length, rather deep and compressed, upper profile strongly curved to snout, rounded between eyes; muzzle bluntly rounded; mouth moderate, oblique; lower jaw somewhat included; maxillary not reaching front of eye; eye rather large, high, its lower margin about on level with upper lip; body deep and compressed; scales large, much deeper than long on side of body forward; 24 on back in front of dorsal; lateral line decurved; dorsal high in front; tips of first rays of dorsal when depressed extending slightly beyond the tips of the last; tips of first anal rays not reaching tips of last rays when depressed; pectorals and ventrals pointed; pectoral not quite reaching ventral; ventral reaching vent, nearly to front of anal; caudal forked; peritoneum black. The above description from a male individual 4.68 inches long from Second Lake.

Five specimens from Round Pond ranged in length from about 4 inches to 5 inches, averaging 4.77 inches; head in length without caudal ranged from 3.95 to 4.34, averaging 4.06; depth 3.95 to 4.34, averaging 4.14; eye in head 3.83 to 4.18, averaging 4.03; snout 3.12 to 3.53, averaging 3.29; scales 40 to 42, averaging 41; dorsal rays 8; anal 9; longest dorsal ray 1.21 to 1.36 in head, averaging 1.29.

Upper part of head, back, and sides shiny metallic blue and olive; margins of scales, nearly to belly and quite to anal, dusky, and otherwise somewhat sprinkled with black dots; belly white; an indefinite dark metallic blue stripe along side, most distinct posterior to dorsal; a black stripe from nape along median line of back, passing each side of base of dorsal, reuniting, and continuing to caudal; fins of male margined with red in breeding season, when all tints are more brilliant. Distinguished from other minnows in the region chiefly by the laterally compressed form and the fact that the scales on the front part of side are deeper than long.

Besides "redfin," English appellations such as "shiner," "minnow," "dace," etc., singly or in conjunction with the attribute "redfin" are common. This is, however, preeminently the "redfin" of anglers, although other cyprinids as well as other fishes have red fins at times, and this species does not always have them. The red fins of this fish are nuptial decorations of the male.

The distribution of the redfin is very extensive. According to Jordan and Evermann it inhabits the entire region east of the Rocky

Mountains except the South Atlantic States and Texas. In First Connecticut Lake it does not seem to be abundant. It is more numerous in Second Lake, where it is said to have been introduced; but the latter statement is unauthentic. There is no evident reason why it should not be indigenous to all these waters, yet it was not secured in Third Lake. It was found in First and Second lakes and in Indian Stream.

The redfin attains a length of 8 inches; the largest obtained here, however, was only 4.87 inches long. It is almost everywhere an abundant species in ponds, lakes, and streams. It is carnivorous, subsisting upon small aquatic animals, insects, etc., like other members of the family, and is not averse to small fishes. In lakes and ponds the redfin lurks around water plants, where its food is most abundant, but on calm evenings it moves about in schools at the surface far from shore, over deep water, feeding upon insects that have fallen upon the water.

Its breeding time is in the spring or early summer, according to the temperature of the water. At this time the male assumes a beautiful coloration, the fins broadly margined with bright red, the back an iridescent blue, and the side reflecting all the hues of the rainbow. A more beautiful minnow can scarcely be conceived. The head of the male at this time bears conical horny tubercles or excrescences, whence the names "hornyhead" and "buckfish." The use of these horns has not been satisfactorily explained. The spawning process is interesting. A small school assembles on a fine gravelly shoal where the water runs swiftly but smoothly just above a riffle. A hollow is formed in the gravel, where the eggs are deposited and fertilized by the male or males in attendance. In the one instance observed there was only one male present.

The redfin will readily take a hook, especially if baited with earthworm. It is also frequently caught on small artificial flies, especially when the fish is feeding upon insects at the surface.

This fish is one of the best live baits, its silvery appearance making it very attractive, and for this reason it is often used to reenforce spinners and spoons, as well as for live bait in still-fishing and in casting.

The best methods of catching the redfin are by minnow traps or with small seine on the shores at the mouths of brooks, particularly where water plants are present.

8. LONGNOSE DACE. *Rhinichthys cataracta* (Cuvier and Valenciennes).

Head 4.22; depth 4.22 in length without caudal; eye 6.28 in head; snout 2.44; dorsal 8; anal 7; scales 13–59–12.

Head low and broad; interorbital convex, 3.14 in head; snout horizontally bluntly rounded, vertically, or in profile, rather sharp, projecting much beyond small, inferior horizontal mouth; lips thick; eye small, about midway

between tip of snout and upper end of gill-opening; maxillary not reaching front of eye, small barbel at tip; gill-membrane broadly joined to isthmus, branchiostegals 3. Body robust, plump, and rounded in front, somewhat compressed posteriorly; arched rather abruptly from occiput; lateral line nearly straight, about in axis of body; dorsal moderate, inserted about midway between tip of snout and base of caudal, first rays longest, 1.57 in head, scarcely extending beyond tip of last rays when depressed; first anal rays extending slightly beyond last when depressed; 1.57 in head; pectorals short, 1.4 in head, inserted low, about on level with mouth; ventral short and somewhat rounded, or with rounded angles, and inserted somewhat in advance of insertion of dorsal; scarcely reaching vent; caudal forked.

Described from a female example 4.54 inches in length, from Round Pond Brook August 12.

Seven specimens from this locality ranged in length from 1.54 to 4.54 inches, averaging 3.30 inches. Head in length without caudal ranged from 3.9 to 4.33, averaging 4.11; depth 4.22 to 5.60, averaging 4.11; eye in head 4.2 to 6.28, averaging 5.39; snout 2.14 to 2.85, averaging 2.51; interorbital 3.14 to 3.50, averaging 3.31; scales 59 to 66, averaging 64; dorsal rays 8, the longest ranging from 1.28 to 1.57 in head, averaging 1.36; anal rays 7, the longest ranging from 1.30 to 1.57 in head, averaging 1.47; pectoral ranging from 1.20 to 1.45, averaging 1.34 in head.

Upper part of head, back, and sides bluish gray, much speckled with brown or darker gray, more intense on some scales than others; maxillary, chin, throat, and belly white; dark speckling often grouped, giving a mottled appearance, and so intense on side, especially posteriorly, as to make a more or less definite lateral dusky stripe. Males in spring with more or less crimson, especially on the lower fins.

Distinguished from the other species by the longer, more projecting snout and lacking the distinct jet black lateral stripe of the other; and from all other minnows in this region except the chub minnow by the inferior position of the mouth; from *Couesius* by the more pointed head and sucker-like appearance; also there are only 7 rays in its anal fin, 8 in *Couesius*.

The above is apparently the only distinctive English name for the fish. "Longnose brook minnow" or "rock minnow" may be suggested.

As previously stated, this species has not before, to our knowledge, been definitely recorded from New Hampshire. Jordan and Evermann give its range as "New England to Virginia and Wisconsin; its varieties ranging to Utah and the Columbia basin." It was collected by us in the following places: First Connecticut Lake in mouth of Mud Pond Brook, tributary brook of Main Inlet, Alder Brook, Round Pond Brook, Outlet Third Lake, and Indian Stream.

This minnow is said to attain a length of 5 inches. Our specimens range from 1.25 to 4.54 inches in length.

The favorite habitat of this species is clear rocky brooks and streams. Jordan and Evermann say that it frequents clear and boisterous streams and rock pools, the specific name, *cataractæ*, meaning "of the cataract," the original type being from Niagara Falls. It feeds mainly upon small aquatic animals, such as worms and larvæ of insects, also upon insects that fall upon the water. The inferior

position of the mouth indicates that it is to some extent at least a bottom feeder. The stomach contents of several individuals from 2.25 to 3.08 inches long from First Lake waters contained fragments of insects, water mites, and insect larvæ. It doubtless eats the eggs of such small fish as breed in brooks and streams where it occurs. It will take a baited hook or a small artificial fly, and is itself a useful bait for large fishes, being hardy and living well in a bait bucket. The spawning time, like that of other Cyprinidæ, is in the spring or early summer, at which time the males are colored somewhat with red.

It is usually hard to get many individuals of this minnow, owing to the difficulty of using a net in the rocky streams where it occurs and its habit of darting under rocks and other shelter for concealment, though a minnow trap in time is effective in getting a fair supply of individuals large enough for live bait. Our largest specimens were taken on a small hook baited with angleworm.

9. Blacknose Dace. *Rhinichthys atronasus* (Mitchill).

Head 4.15 in length without caudal; depth 4.9; eye 4.33 in head; snout 2.60; dorsal 8; anal 7; scales 11–62–7. Head long, rather sharp, mouth small, lower jaw included, somewhat inferior, nearly terminal, slightly oblique; maxillary not reaching anterior border of eye, small barbel at tip; eye large, high, about midway between tip of snout and upper end of gill-opening. Body plumply rounded in front, compressed behind; scales small, lateral line nearly straight, about in axis of body; dorsal nearer base of caudal than tip of snout, the first rays highest, 1.3 in head, extending considerably beyond tips of last rays when depressed; rays of first half of anal longest, 1.23 in head, reaching much beyond the last rays when depressed; pectoral rounded, not reaching nearly to ventrals; ventrals rounded, reaching vent; caudal forked.

Top of head and back green-gray; back and side thickly spotted and dotted with dark brown to lateral line, some of the spots linear, all made up of dots; few round and linear groups of dots below lateral line on side of belly and caudal peduncle; a jet black stripe from snout through eye to base of caudal ending in a black spot on the base of the caudal fin; all below the stripe except the few spots on the side abruptly white; fins all pale.

Description taken from a male individual 2.7 inches long from outlet of Third Lake August 18.

This species varies but little in color. The young have the black stripe more distinct, also a more sharply defined black spot on the caudal. Some individuals have a border above the lateral stripe, of lighter shade than the ground color of the body, and breeding males have broad red borders to the lower fins and sometimes red on the sides, and the light border above mentioned a beautiful golden red hue.

Distinguished from the other dace by the less projecting snout and black lateral stripe extending on the snout; from other minnows of this region by the same characters.

This species of dace does not lack for local names. It is variously known as "rock minnow," "brook minnow," "rock shiner," "pot-belly," "pottle-belly," etc. The last two names are derived from the

frequent distended appearance of the abdomen due to tapeworms with which the fish seems to be extensively affected.

Its range is somewhat greater than is given by Jordan and Evermann, reaching to New Brunswick and Quebec and in the United States extending south to northern Alabama and west to Minnesota at least, the form running into several varieties. Ernest Thompson-Seton does not mention it as occurring in Manitoba. We collected it in Mud Pond Brook, in Round Pond Brook, in a rivulet affluent of Main Inlet above mouth of First Lake, in Main Inlet at mouth of Coon Brook, at the mouth of East Inlet of Second Lake, along shore of Third Lake, in Third Lake at outlet, and in Indian Stream. It attains a length of about 3 inches and is usually very abundant throughout its range in clear streams. Specimens collected measured from 1.29 to 2.95 inches in length. In the upper Connecticut waters it appears to be less abundant than its congener, although locally it was somewhat more numerous at times. Like the other dace, it feeds upon small aquatic animals and insects.

Young individuals from about 1.29 to 1.66 inches long were found to be feeding upon diatoms, entomostraca, small aquatic worms, and fragments of insects.

The spawning time is in the spring and early summer, when the males assume a more brilliant coloration, more or less red being evident, and often the intensely black stripe seems to be margined with reddish golden or bronze.

The larger individuals of this little species are hardy and make an attractive bait for salmon and trout. They may be caught with a small hook and worm bait, but this is a slow method. The most satisfactory means is by minnow traps; a small seine or dip-net is sometimes effective in brooks that are clear enough, where the ingenuity of the fishermen may indicate ways and means of driving the fish into the nets.

10. Chub-minnow. *Couesius plumbeus* (Agassiz).

Head 4.45 (3.7 to 5.2); eye 3.75 (3.3 to 4.2); snout 3.35 (3.07 to 3.8); dorsal 8; anal 8; scales about 65 (60 to 70) in lateral line, about 34 (31 to 37) before dorsal fin.

Body elongate, not compressed; head flattish above; snout broad, somewhat projecting over the moderate, somewhat oblique mouth; maxillary barely reaching front of eye; barbels on maxillary always evident; eye large, nearly equaling snout; pharyngeal teeth said to be normally 2, 4–4, 2 (in our specimens variously 2, 4–4, 2; 2, 5–4, 2; 2, 4–4, 1; 1, 4–4, 1 and 1, 4–4, 0). Scales small, crowded forward, those on the back smallest; origin of dorsal nearly midway between tip of snout and middle base of caudal, being slightly nearer latter; longest dorsal ray about 1.4 in head, the anterior rays longest; free margin of fins slightly concave; longest anal ray from 1.2 to 1.6, its form similar to that of dorsal; caudal forked; pectoral rounded, reaching nearly to base of ventrals, 1.2 to 1.6 in head; ventrals reaching vent, about 1.6 in head.

Color, dusky above, sides somewhat silvery, darker above; an obscure dusky lateral band passing through eye and around snout. In the breeding season bases of ventrals and pectoral, angles of mouth and under mouth very distinctly red, the red most distinct in the male; dark lateral stripe also very distinct.

Distinguished from all other minnows in this region, excepting the two daces, by the rather inferior position of the mouth; from the daces by differences noted in diagnosis of longnose dace.

There seems to be no distinctive name for this fish other than the above, which is coined to supply the deficiency. The name seems properly applicable since the fish is a minnow closely related to the chub.

The recorded range of the species is not very wide: the Great Lakes, upper St. Lawrence, northern New York and northern Vermont, Maine, and New Brunswick. It probably occurs in many other places which more extensive collections will reveal. In this region it was almost everywhere common. We collected it in Indian Stream, all three Connecticut Lakes and inlets, and in Round and Mud ponds. In Round Pond and Third Lake it runs somewhat larger than in First and Second lakes, reaching a known length of about 5 inches.

The chub-minnow feeds chiefly upon animal food, as insects, etc. It will also eat small fish; individuals have been found gorged with chopped fish and corn meal, which had been used to attract fishes to the seine. It seems to be very abundant wherever it occurs, being primarily a pond or lake fish, ascending streams in spring and early summer to spawn. In some streams, however, it is a permanent resident. In this region the spawning season seems to be in the early part of July. In Mud Pond Brook, particularly, individuals were found in abundance in spawning condition at this time. In the spawning season the first runs of fish seem to be mostly males, as is the case with smelts; later the runs include both sexes. Many of these fish, but particularly the males, linger in the brooks after the spawning season, which also seems to be the case with many other species of fish. The ascent of streams for the purpose of spawning seems to be mainly at night and on cloudy days, when the fish run in schools. A small unbaited wire minnow trap took from 50 to 100 in a single night. The following is a detailed account of observations upon the runs of this species in Mud Pond Brook near the mouth:

July 2: Thirty-nine caught; many of them showing red markings very distinctly.

July 3 to 5: Trap down 2 nights, took 122, many of the specimens showing red coloration at base of pectorals and ventrals, and at angle of mouth; the dark lateral stripe very distinct.

July 6 to 7: Trap down 2 nights. Several dozen, all in spawning condition.

July 13 to 15: Trap down 2 nights, contained only 22 specimens, most of them spent. The spawning season in this brook seemed to be

about over by the middle of July, but in a small tributary of Main Inlet on the night of the 15th about 100 were taken in a minnow trap, most of them in spawning condition.

July 18 in this same stream only a few were taken. These were also in spawning condition.

July 22: One ripe male; very scarce in this brook now. Only a few stragglers in spawning condition.

July 26: Only one, spent fish, sex not determined.

August 12: Several caught, all spent, and very thin and attenuated; 4 examples, all spent, were caught in Round Pond Brook.

In this lake these fish are so small that a female carries comparatively few eggs, but the species is, nevertheless, rather prolific. One specimen 4.5 inches long contained 710 eggs.

The proportional numbers of males and females at different periods is indicated by the following notes:

Of 76 specimens taken in Mud Pond Brook on the nights of July 3 to 5, only 4 were females.

Of 35 specimens taken in same place, nights of July 13 to 15, 9 were males and 26 females.

Of 33 specimens taken in tributary of Main Inlet night of July 15, 13 were males and 20 females.

In the lake or pond this species is gregarious. It is most commonly seen about twilight in calm evenings, when the "rises" may be observed everywhere, as it feeds upon small insects at the surface. It may also be seen in schools, rippling the water at the surface as it moves about. In early evening it approaches more closely to the shore; at other times it resorts to comparatively deep water. In First Lake it was taken in a minnow trap in 30 feet of water; in Second Lake it could be caught near the shore at almost any time of day, but best in morning and evening. In Third Lake large schools were observed on August 19 moving about, but chiefly near the west shore, and some were caught on tiny artificial flies. The size and abundance of the chub-minnow make it an important food for game fishes, and it is an excellent live bait for trout and salmon.

11. Eel. *Anguilla chrisypa* Rafinesque.

This fish is so well known that only a few local peculiarities need be noted here. Head broad and flattened, 2.25 in trunk; snout blunt, mouth moderate, the gape 3.8 in head; lower jaw projecting; lips fleshy; eye small, 3 in gape of mouth; interorbital 1.4 in gape.

Color in life very dark olivaceous, almost black; yellowish white on lower jaws and under parts. Described from a specimen 32.25 inches long caught on a hook in First Lake, July 22, near surface where the water was 60 feet deep.

There is no other common name for this fish except some that apply to different sexes, ages or appearance, such as silver eel, broadnose eel, sharpnose eel.

The distribution of the eel on the Atlantic coast and in the inland waters of eastern North America is pretty extensive, ranging from as far north, at least, as the St. Lawrence River and south to the Gulf of Mexico and West Indies; ascending all rivers within its range, oftentimes to their very sources.

It is very common in the Connecticut Lakes. It was collected in First and Second lakes but not in Third, though it doubtless occurs there. In fresh water the eel sometimes reaches a monstrous size, one weighing 13 pounds having been reported. Those caught in the Connecticut Lakes were not weighed, but 4 specimens measured, respectively, 27.75, 28.75, 32.25, and 33 inches in total length.

In lakes during the daytime the eel remains in rather deep water, approaching the shore at night to feed. Specimens were caught in these lakes in water from 30 to 60 feet deep. Some of them were caught on night lines, others on live bait in stillfishing, at which time some were hooked when not more than 5 or 10 feet below the surface, although the water was about 60 feet deep. The bottom here was soft mud.

The eel subsists upon almost any kind of animal food. It can and does catch live fish for itself and feeds also upon worms, insect larvæ, small mollusks, and not infrequently upon fish eggs when they are obtainable.

The spawning habits of the eel are not fully understood. The sexes are easily distinguished by an examination of the internal reproductive organs, which extend along the backbone and are commonly regarded as fringes of fat. It is claimed by some that only female eels occur in fresh water, which they enter as young fish. When ready to spawn they descend to salt water. Spawning takes place in late fall or early winter, and the females, at least, are said to die after performing that function. In early summer myriads of young eels but a few inches long are observed ascending the streams and rivers. It seems to require a formidable obstruction to stop their progress, nothing short of a cataract sufficing. The very young of the eel before the anadromous migration begins is a peculiar, colorless, transparent, ribbon-shaped larva, called the *Leptocephalus* stage, bearing but little resemblance to an eel.

In winter, in cold localities like New England, the eel burrows in soft mud, and there hibernates. It is a valuable market fish and by many is highly esteemed as food. It is usually caught for the market by means of traps, weirs, and pots, or by spearing in the mud during the hibernation period.

The angler sometimes hooks an eel which by its vigorous pulling, tugging, and shaking causes him to think that he has a trout of generous proportions. But dismay, disgust, and infinite trouble and slime accompany the advent of the capture into the boat.

12. Round Whitefish. *Coregonus quadrilateralis* Richardson.

Plate VI.

Head 4.67 in length without caudal; depth 4.67; eye 4.60 in head; snout 3.53; maxillary bone 5.11; dorsal 11; anal 11; scales 10–83–8.

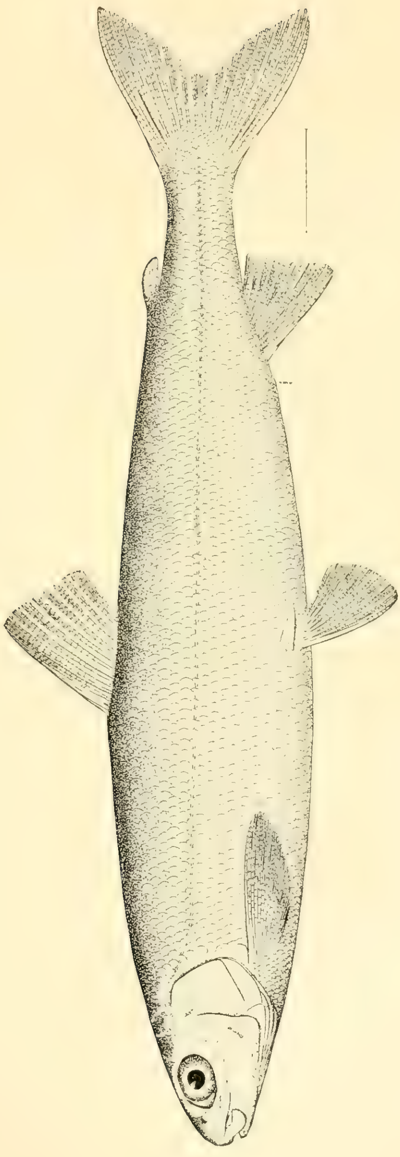
Head sharp, upper profile strongly curved downward to snout; snout beak-like, sharp, compressed, projecting; mouth small; distance from tip of snout to posterior extremity of maxillary 4.60 in head; maxillary not reaching front of eye, mandible 2.87; lower jaw included; eye large; interorbital moderate, 3.83 in head; body fusiform, caudal peduncle rather slender; pectoral moderately long, pointed, 1.31 in head; dorsal moderate, first rays longest; 1.43 in head, when depressed scarcely reaching tips of the last ray; margin straight when spread, base 2.09 in head; anal falcate, first rays longest, 1.76 in head, tip when depressed extending considerably beyond tip of last rays, base 2.42 in head; caudal forked.

Top of head and back grayish olive; sides and belly silvery and white; caudal dusky, other fins pale; pectoral tipped with dusky. Description from a male specimen 10.41 inches long from northern Maine, November, 1901. Lower fins of males reddish in life during breeding season.

In this region distinguished from all other fishes but the smelt and salmon family by the presence of the fatty or adipose fin on upper part of tail; from all other members of the salmon family except other whitefishes by its plain coloration; from other whitefishes by its small mouth and "bill"-like snout and fusiform body; from the smelt by its small toothless mouth.

"Billfish" seems to be a local name for this fish restricted to First Connecticut Lake, applied because of its compressed snout, which gives it a beak or "bill"-like appearance. It is one of the whitefishes and is known in the books as "round whitefish" in allusion to its spindle or fusiform shape in contradistinction to the compressed or laterally flattened form of the other species. In Maine it is called the "chiven" or "chivy," a corruption and transappellation of chevaine, the French name for the chub. In some parts of New York it is called the "frost fish," and "menominee" is an aboriginal name. It seldom attains a weight of much over a pound and the average weight is considerably less.

The round whitefish is widely distributed in northern regions, ranging from New Brunswick through New Hampshire, northern Vermont, and the Great Lakes, northward to Labrador and northwestward to Alaska. It was described by Prescott in 1851 from Lake Winnepesaukee, under the name *Coregonus Novæ-Angliæ*, "shad-waiter," or "New England whitefish." It doubtless occurs in other New Hampshire waters. It has been reported from First Connecticut Lake under the name of "billfish." In the New Hampshire Fish and Game Report for 1892, page 90, it is recorded from Connecticut Lakes as follows: "They [Connecticut Lakes] are well stocked with minnows and small whitefish (*Coregonus quadrilateralis*), known locally as 'billfish.'" Its occurrence in the other Connecticut Lakes could not be learned of, though there is a reliable report of its capture this year in Main Inlet by hook and line at the mouth of Coon Brook.



BILLFISH, OR ROUND WHITEFISH (*Coregonus quadrilateralis*).

It is related that years ago lumbermen used to net this fish in large quantities during the spawning time in this place. It is said not to be abundant now.

In the summer this whitefish, like the other species, affects cool water and consequently usually frequents the deeper water of the lakes. In the early evening in calm weather it approaches the surface, where it feeds upon insects that have fallen upon the water. Its mouth is small, therefore it is not frequently taken on baited hook or fly. It ascends streams to spawn the last of October and first of November. It is said that the spawn is emitted at the surface of the water, one or more males accompanying the female during the act. The eggs are at first semibuoyant, but gradually settle to the bottom and are hatched in the early spring on rising temperature.

The usual method of capture is by nets on the spawning grounds or when the fish is approaching those places. This is an excellent pan fish, and in city markets often appears as smoked whitefish or lake herring, which, when baked or broiled, makes a delicious breakfast dish.

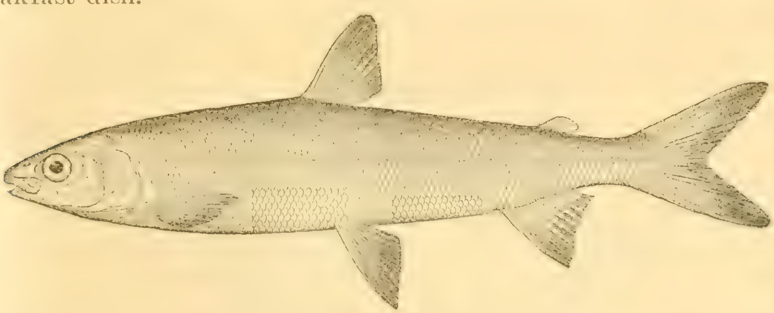


FIG. 1.—Whitefish. Length, 11¼ inches.

13. GREAT LAKES WHITEFISH. *Coregonus clupeiformis* (Mitchill).

Plate VII and fig. 1.

Head 4.59 in length to base of caudal; depth 4.34; eye 5.43 in head; snout 4.35; maxillary 3.95; mandible 2.9; interorbital 3.62; dorsal 12; anal 13; scales 10–83–8; gillrakers 10+18 and 11+17 on right and left sides respectively, the longest about 1.64 in eye.

Body rather long and compressed, the back somewhat arched in front; head small and short; snout short and blunt; mouth small, nearly horizontal; maxillary short, broadly ovate; lower jaw included, the blunt snout somewhat projecting; dorsal moderately high, about 1.45 in head; anal about 2.28 in head.

Upper part of head and body dusky olive, punctulate; throat and belly white; membrane of all the fins black.

The above description is taken from a spent female about 19.5 inches long from Umbagog Lake, N. H., collected in the winter of 1903. This specimen is selected because it shows the changes sometimes incident to transplanting and which would most likely be the appearance that the same species would assume in the Connecticut Lakes. A male fish 15 inches total length had the following proportional measurements: Head 4.24; depth 3.52; eye 4.86; snout 3.84; dorsal 11; anal 11; gillrakers 10+18 and 10+17; longest 1.87 in eye. Color about as in the other.

In the Great Lakes whitefish corresponding measurements vary somewhat and the color is decidedly different, this usually being "satiny white all over; back with faint olive-green shade; fins all white, except the caudal, which is usually slightly dark-edged."

The points of difference between this species and the billfish have been given under the latter species. From its allied form, the common whitefish of Maine (*Coregonus labradoricus*), it is difficult to distinguish it. A slight difference, but one that appears to be constant, is in the upper profile of the head. In *C. clupeiformis* this profile is slightly concave in outline, the posterior part of the head (occipital region) sloping up in conformity to the arch of the back. In *C. labradoricus* this profile is straight, the arch of the back if present beginning abruptly from the upper outline of the occipital portion of the head. There is also an average difference in the number and length of the gillrakers. The small toothless mouth separates it from all other fishes having the gristly or adipose fin on the back behind the rayed fin, and from all the other species it is distinguished by the presence of this fin.

Other names for this fish, used chiefly in the Great Lakes neighborhood, are "humpback whitefish," "bowback whitefish," "highback whitefish," and "Otsego bass," the latter being restricted to Otsego Lake, N. Y.

The general range as given by Evermann and Smith is throughout the Great Lakes region from Lake Champlain to Lake Superior and Lake Winnipeg, but its presence in the latter lake is doubtful. It has been introduced into several bodies of water in New Hampshire, including the Connecticut Lakes, but the only waters from which it has been recorded are Lake Umbagog and perhaps Winnipesaukee. There is no evidence that this species or its related form *Coregonus labradoricus* [a] is indigenous to any of the Connecticut Lakes. The reasons are not apparent, since the waters seem to be well suited to it. There is, moreover, no authentic report of any having been seen since its introduction. The records of the plants, brought from Michigan, are as follows: 1897, 50,000 fry; 1899, 40,000 fry. The latter record does not state definitely that the fish were put into the Connecticut Lakes, but this is to be inferred from the fact that they were delivered at Pittsburg. In 1901, 75,000 or 80,000 fry were planted, making a total of 170,000.

The whitefish has been observed to feed chiefly upon small animals, such as shrimp, water-fleas, small mollusks, worms, insect larvæ, and small fishes. The Maine whitefish has been known to eat its own eggs upon the spawning ground.

The whitefish reaches maturity, according to Evermann and Smith, at the age of 3 or 4 years, and deposits from 10,000 to 75,000 eggs, the number depending upon the size of the fish. The spawning time is in the late fall, chiefly in November. In the summer it retires to the deeper portions of the lakes, but as the time for spawning approaches

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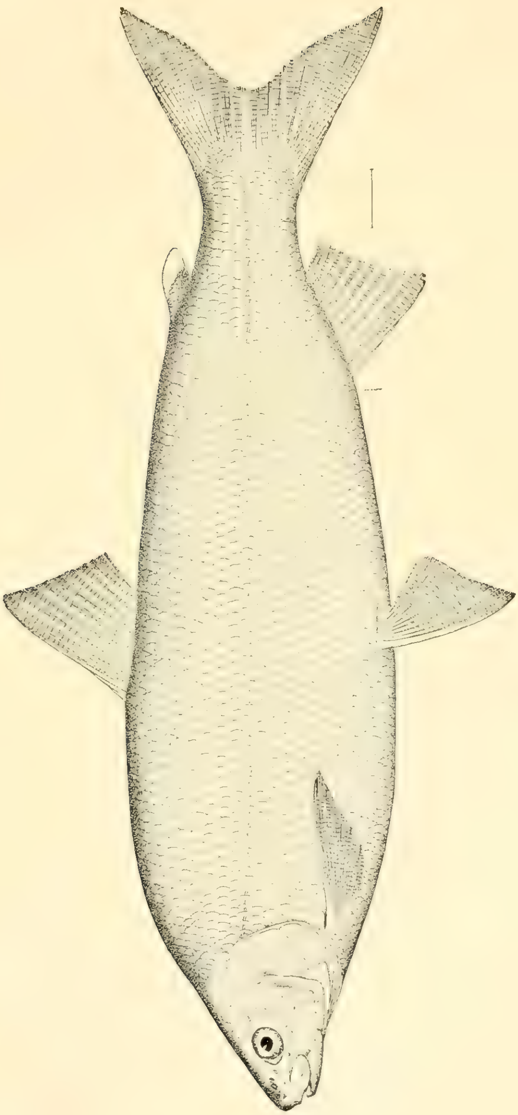
[a] Dr. Bean claims that these two forms are specifically identical. See Science, N. S. vol. IX, no. 220, pp. 416–417, March 17, 1899.



GREAT LAKES WHITEFISH. ADULT. (*Coregonus clupeiformis.*)

it comes into shoal water about the islands and in the bays and coves. In some waters this fish attains a weight of 10 pounds or more. The Maine whitefish (*C. labradoricus*), native also to some New Hampshire waters, notably Lake Winnipesaukee, differs somewhat in its habits from the description above given. In the summer it is found in cool water, usually in lakes, but not infrequently in streams. In early evening it approaches the surface to feed upon small insects and the like.

The common whitefish is one of the most highly prized food-fishes of fresh waters. In the Great Lakes it is most commonly caught in gill-nets in the fall. It is said to be taken occasionally in those waters on a baited hook or artificial fly. In northern Maine this is a common occurrence with *C. labradoricus*. The latter has been caught in Moosehead Lake by deep fishing with bait and once in a while on a fly; in the Fish River Eagle Lakes of Aroostook County it is taken by trolling with small spoon and hooks baited with worms, and on small artificial flies. To angle successfully for whitefish a light flexible rod

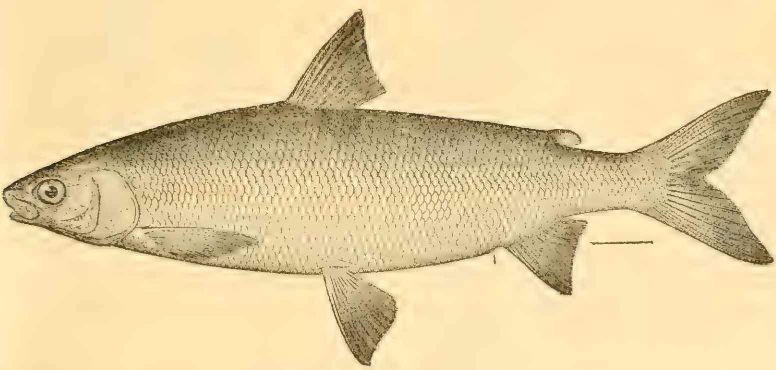


FIG. 2.—Maine whitefish.

and small gauze-winged flies are desirable. The fish is gamy when hooked and will out-rush, out-leap, out-twist, or out-maneuver any other fish of its size. This sport is rendered still more exciting from the care that must be exercised to retain the fish, since the small hook that must be used is easily torn from the tender mouth. The Umbagog Lake whitefish which, as remarked before, are quite positively the results of plants of Michigan whitefish made by either the Maine or New Hampshire Fish Commission, or both, are caught by fishing with small bait through the ice.

14. QUINNAT SALMON. *Oncorhynchus tschawytscha* (Walbaum).

Plate VIII.

Head 4 in length without caudal; dorsal 11; anal 16; gill-rakers usually 9+14; branchiostegals 15 or 16 to 18 or 19, the number on the 2 sides always unlike; teeth comparatively small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing in the males.

In the males in late summer the jaws become elongate and distorted, and the anterior teeth much enlarged, the body becomes deeper, more compressed and arched at the shoulder and the color often nearly black. Usual color dusky above, often tinged with olivaceous or bluish; sides and below silvery; head dark slaty, usually darker than the body and little spotted; back, dorsal fin, and tail usually profusely covered with round black spots (these are sometimes few and rarely altogether wanting); sides of head and caudal fin with a peculiar metallic tin-colored luster; male about spawning season (October) blackish, more or less tinged or blotched with dull red. Length 2 to 5 feet; usual weight in Columbia River 22 pounds, in the Sacramento 16 to 18 pounds; in smaller rivers less, but individuals of 70 to 100 pounds have been caught. Easily distinguished from all other Salmonidæ in this region by the larger number of anal rays.

This salmon has various names in the east, such as "California salmon," "Sacramento salmon," and "quinnat salmon," probably the last name the one most generally used. In the west its names are even more numerous: "Quinnat salmon," "tschaviche," "king salmon," "Columbia salmon," "Sacramento salmon," "chinook salmon," "tyee salmon," "tschawytscha." Perhaps "chinook" would be the best, as it is in quite general use. In its native waters this salmon ascends the streams for many miles, in some instances fully 2,000 miles from the sea to spawn. It spawns in October and November and then dies, thus spawning but once in its lifetime.

There have been many attempts to acclimatize this salmon in eastern waters, but without success. There are but 3 authentic reports of adult chinooks taken in the east. One was in Lake Ontario a number of years ago; the others in Sunapee Lake, New Hampshire, and Pierce Pond, Maine, in 1906. When ascending fresh water to spawn it does not feed and will not take a hook. In salt water it is caught by trolling with artificial lures and bait, such as herring or squid.

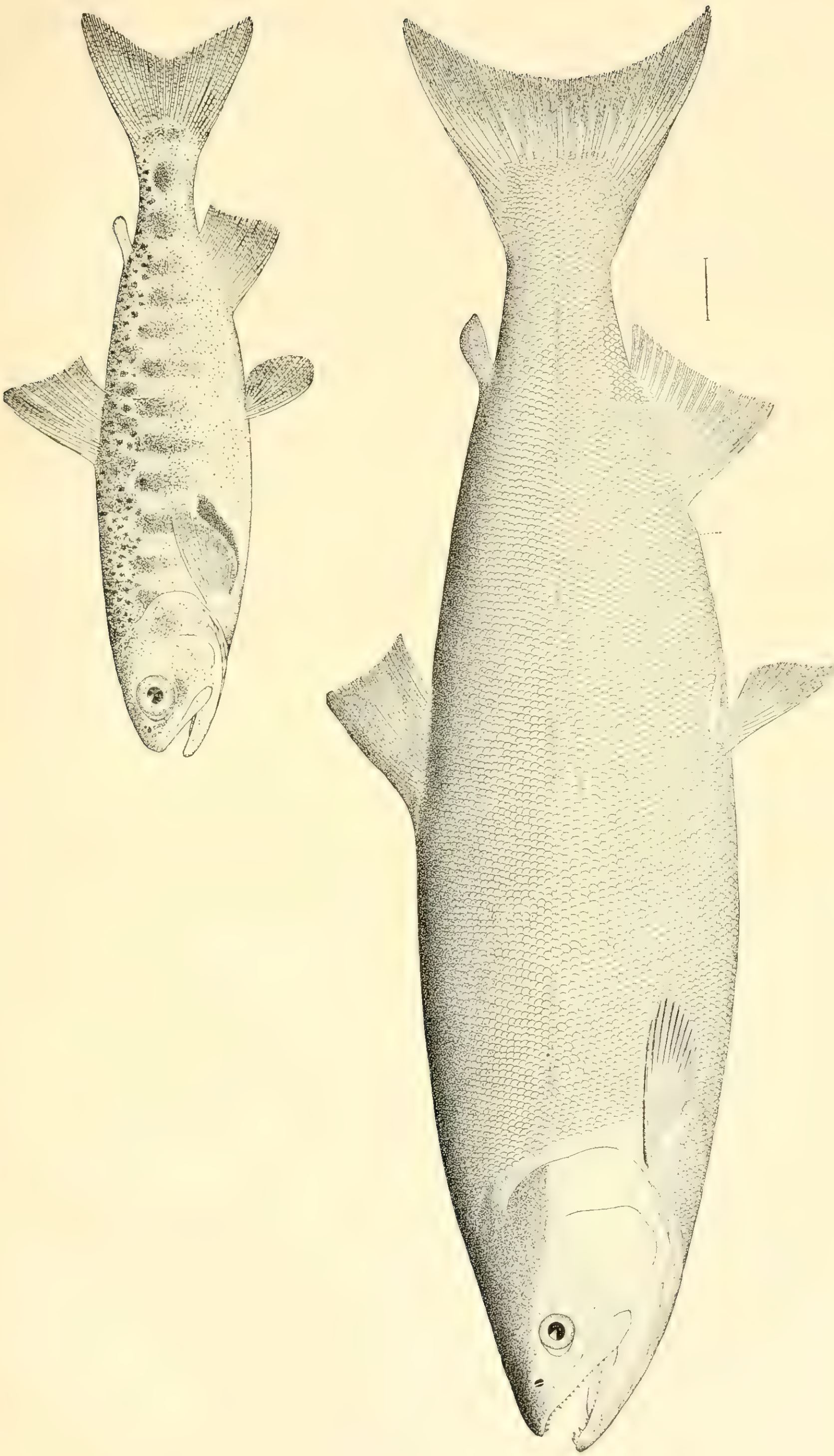
In 1904 several thousand fry were planted in First Connecticut Lake waters. On July 7 we took in a minnow trap in Mud Pond Brook, near the lake, 1 specimen about 2 inches long. These fry are distinguishable by the large number of anal rays, though in general appearance they greatly resemble a landlocked salmon. They are, however, somewhat deeper and relatively shorter. There are 9 or 10 vertical spot-like parr marks on the side and smaller close-set spots on the side of the back.

15. Landlocked Salmon. *Salmo sebago* Girard.

Plate IX.

Head 4.36 in length without caudal; depth 3.58; eye 7.74 in head; snout 3.45; maxillary bone 2.09; dorsal 12; anal 9; scales 20–116–21.

Head comparatively short, bluntly conic; mouth moderate, sharp teeth on jaws, vomer and palatines; vomerine teeth in a single row on shaft; distance from tip of snout to posterior extremity of maxillary 2.21 in head; lower jaw slightly hooked, mandible 1.72 in head; branchiostegals 11 on right side and 12 on left; gillrakers 8 + 13 on right side, 7 + 13 on left, longest 2 in eye. Body



QUINNAT SALMON (*Oncorhynchus tschawytscha*).
Upper figure from a young example 4 inches long.

rather deep, somewhat compressed; caudal peduncle comparatively short and deep. the distance from adipose to upper base of caudal 2.38 in head; distance from posterior base of anal to lower base of caudal about 1.93; least depth of caudal peduncle about 1.13 in first distance, 1.39 in the other and about 2.70 in head; pectoral moderate, 1.47 in head; longest dorsal ray much longer than base of fin, reaching when depressed to about the middle of the last rays, their length 1.78 in head; base 1.82; first rays of anal longer than base, the tip reaching, when depressed, the tips of the last rays; length 1.93 in head; base 2.48; ventral rather short, 2 in head; caudal deeply lunate.

Top of head and back olive-green, most intense on edge of scales; side of head and body to level of lower fins iridescent silvery; ventral region from tip of lower jaw to base of anal white; scales on side of body below lateral line punctulated with dusky; large round black spots on side of head; tip of lower jaw black; large irregularly formed black spots on side of body nearly down to level of pectoral forward, none below lateral line posteriorly; shape of spots determined much by the scales occupied, being more or less definitely blotch-like, X and XX, crescentic and double crescentic; largest spot covering 6 scales; dorsal olive, 2 rows of dark spots along lower part; adipose dark olive; caudal olive; pectoral white below with dusky margin, first ray dusky olive; ventral white below, somewhat dusky above; anal soiled white.

Description from a male specimen 20 inches long caught in June, 1903, in Sebago Lake, Maine.

The following notes were from 2 specimens in breeding condition, taken in Grand Lake Stream, Maine, November, 1899:

(1) Male, 23.75 inches total length; head in length without caudal 3.56; depth 4.44; eye 9.12 in head; snout 2.31; maxillary bone 2.70; dorsal 12; anal 9; scales 24–116–23; head long, snout slightly curved; mouth large; distance from tip of snout to posterior extremity of maxillary 1.85 in head; lower jaw hooked, fitting into socket in upper; mandible 1.56 in head; gill-rakers 7+12 on right side and 8+12 on left; branchiostegals 10 on right side, 12 on left; body comparatively deep and somewhat compressed; caudal peduncle short and deep; length of dorsal base 2.24 in head, slightly longer than longest ray, which is 2.26 in head; length of anal base considerably shorter than longest ray, 3.24 in head; longest ray 2.7 in head; pectoral moderate, 1.71 in head; ventral equal in length to base of dorsal, 2.24 in head; caudal broadly emarginate.

Top of head and back as far down as lateral line olivaceous; side of head greenish and dusky; variously shaped spots, of greatest intensity on edges of scales, some of them X-shaped, along the sides, dark brown and almost black, bordered by light brown, those on lateral line with red center; few large brown spots on cheek; indistinct chrome yellow below lateral line; dorsal fin dusky olive, with 2 rows of dark-brown spots along the lower part; pectoral dusky outside, greenish within, with broad dusky marginal band on tip; ventral the same; caudal dusky olive-green; chin dusky; throat white, isthmus slaty; belly white with dusky blotches.

(2) Female, 23.33 inches in total length; head 4.95 in length without caudal; depth 5.18; eye 6.82 in head; snout 3.05; maxillary bone 2.63; dorsal 11; anal 9; scales 23–116–25; head, snout, and lower jaw much shorter than in male; mouth smaller; distance from tip of snout to posterior extremity of maxillary 1.96 in head; lower jaw not hooked, length of mandible 1.70 in head; gill-rakers 7+12 on each side; branchiostelgals 11 on right, 12 on left side; body moderately deep and not compressed; caudal peduncle short and deep; caudal broadly emarginate; longest dorsal ray much shorter than base, 2.03 in head; base 1.75;

anal base longer than its longest ray, 2.23 and 2.36 in head, respectively; pectoral 1.47 in head; ventral 2.03.

Back dusky with silvery luster and numerous black and dark-brown spots, some with faint aureola of brownish; large round ocelli on cheek and opercles; shape of spots on side determined by the scales occupied by the spot; ×, ××, and double crescent-shaped, and others variously irregular; few faint orange spots on caudal peduncle; general tone silvery with dusky blotches; dorsal with rows of black spots; adipose and caudal dusky olive.

The above descriptions were taken from fresh dead specimens; therefore the general shades are somewhat darker and bright colors more subdued than in living fish. These are good average descriptions of fair-sized salmon, but comparatively large for the region whence they came. In structure and color the fish from the same locality vary considerably; those from different localities vary much more; therefore, in comparing specimens with these descriptions due allowance should be made for the variations.

Distinguished from all other members of the salmon family occurring in this region, or introduced, by the general color. It is most likely to be confused with the brown trout. The presence of white outer or first rays of the ventral fins in the latter amply serve to distinguish the one from the other.

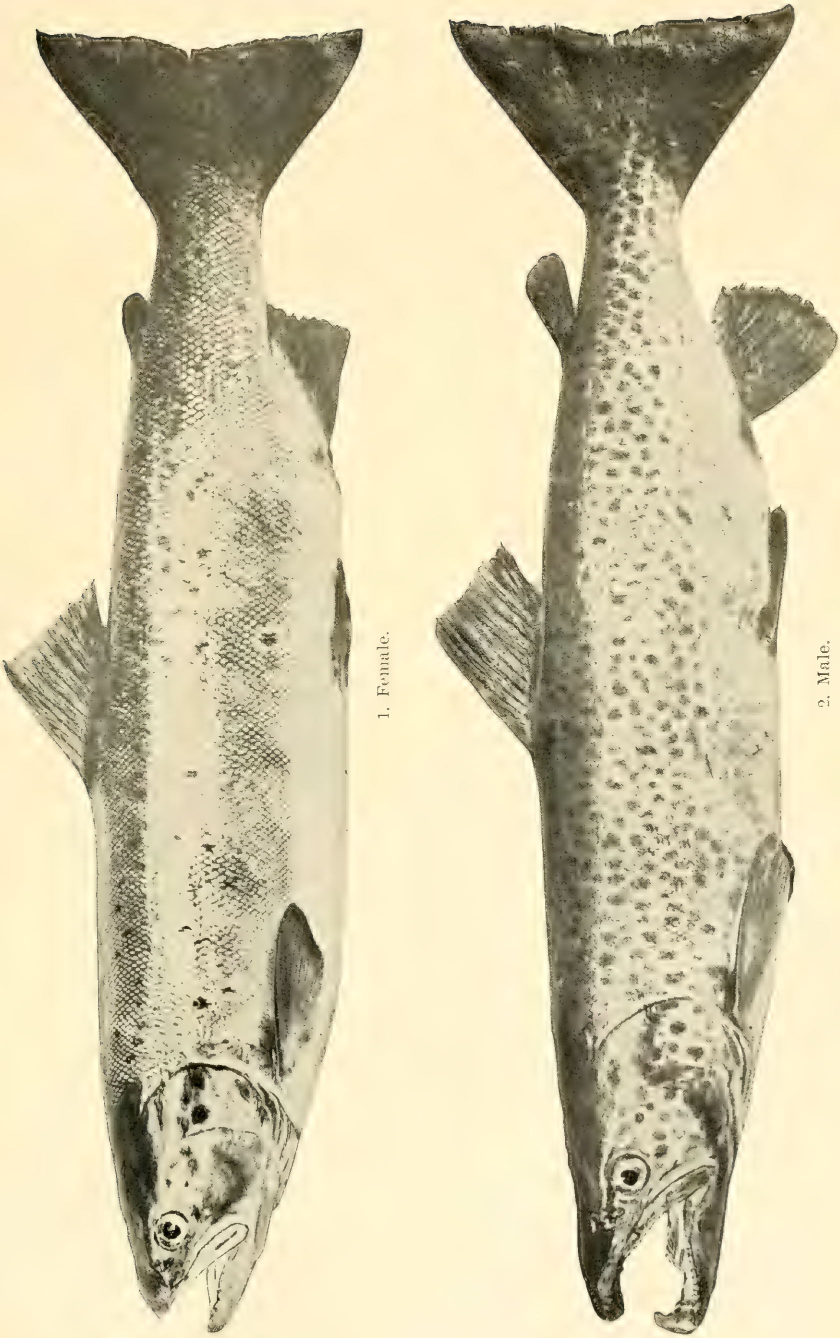
This fish is otherwise known as "salmon trout," "blackspotted trout," "white trout," "schoodic salmon," and "Sebago salmon." Lately, in parts of Maine, the name "ouananiche," which belongs to another species, has been erroneously applied to this. "Landlocked salmon" is a misnomer; it is, moreover, not euphonic, and long custom alone partly justifies its use; "fresh-water salmon" would be more appropriate.

This species is naturally restricted to 4 river basins in Maine, and to a limited area in each, and to one or two localities in New Brunswick, if the fish found there is the same species. In its native waters its existence seemed to depend in some way upon the presence of smelts. It is an introduced species in the Connecticut lakes, and has been successfully acclimated in waters to which it was not indigenous, especially in New England and New York. In the Connecticut Lakes introductions of young have been made as follows:

Second Lake:	
1879	80,000
1888	40,000
1888	20,000
First Lake:	
1892	25,000
1895	20,000
First Lake—Continued:	
1896	20,000
1900	12,000
1901	17,000
1903	1,000
1904	10,000
1906	834

In the report of the New Hampshire Fish and Game Commission for 1892, page 90, the following statement appears:

There were transferred to this hatchery [Colebrook] 25,000 eggs of the landlocked salmon. The young fry were planted in tributaries of the First Connecticut Lake. The former plants of salmon made in this lake showed up this season finely, many fine specimens weighing from 4 to 6 pounds being taken. The waters of these lakes are well adapted to this king of game fishes. They



1. Female.

2. Male.

BREEDING LANDLOCKED SALMON (*Salmo sebago*).

are well stocked with minnows and small whitefish (*Coregonus quadrilateralis*), known locally as billfish. The stream flowing into these lakes are free from sawdust, and afford fine spawning grounds for adult salmon.

Some salmon are caught every year, but nothing could be learned regarding the abundance in the lakes.

The salmon subsists upon fish and insects and, as indicated before, in its native waters particularly upon smelts. In some waters this relation to smelts to a great extent determines the time and method of angling for the salmon. In the spring, when the smelt ascends streams and brooks or approaches the shore for the purpose of spawning, the salmon follows it and feeds greedily upon it. The salmon is then taken by trolling, with any bright lure, but mainly hooks or spinners, with a smelt or shiner bait. At this season it may be caught also by casting a bait, or sometimes a fly, in streams, where it seldom lies in an eddy or pool, but just in the edge of the swiftest flowing water, feeding upon fish as they appear, or aquatic larvæ of insects, and occasionally insects at the surface. When taking bait it is sometimes, but not always, rather particular or capricious. Sometimes any kind of a bait, from a tinsel imitation of a fish or a bunch of earthworms to a spinner or smelt, is acceptable. Again, it will take only one or the other; at other times, if it will take anything at all, it may take only artificial flies and only certain kinds of these; the killing flies of any body of water must be learned by experience. In some water bright flies like Scarlet Ibis, Silver Doctor, and the more somber Jockscot are killers; in others only plain flies will attract the least attention. They may be dark or light, but without much, if any, red or other bright color. The salmon in some waters may be caught all summer and into September; in others it seldom bites much after the first part of July, and in September it begins to run to the spawning grounds, the run continuing well into November. The spawning, as a rule, takes place in November and the eggs hatch in the following spring. In most instances, if possible, salmon ascend or descend streams, to spawn upon gravelly bottoms in quickly running water. When streams are not available the operation takes place on gravelly shoals of the lake. In such places a hollow is made in the gravel, which serves as a nest. These are sometimes termed "redds."

There are more or less structural and chromatic changes in the fish at the approach of the breeding season. The jaws of the male are prolonged, the under jaw becomes hooked, owing to a cartilaginous knob which fits into a socket in the snout, but in some cases it passes up over the end of the snout. The hooked lower jaw of the male persists for a long time, the long-jawed hungry fellows being frequently caught in the spring. In many instances the fierce appearance of these fish have caused them to be mistaken for or regarded as other

species. The colors of both sexes become brighter, brown, orange, and yellow and blue appearing on the bodies, especially the male, and faint orange spots appear on the tail, which at other times is spotless. The salmon practically cease feeding at this time. They probably do not breed oftener than every other year.

The salmon of First Connecticut Lake probably spawn in the Main Inlet. Judging from their size, young salmon remain on the spawning grounds or in the streams for one, two, or even three years. Salmon parrs frequently have red spots on the side.

By many it is considered necessary to screen lakes to retain landlocked salmon. This seems wholly unnecessary unless it is desired to restrict *all* to the lake. Some young salmon will be carried downstream by freshet, and under favorable conditions others will voluntarily go down into outlets of lakes, but will not traverse uncongenial places for any great distance. Occasionally one or more, perhaps, may make their way to salt water, but not in sufficient numbers to deplete the lake. Then, too, the screens usually employed will prevent only large fish from entering the outlet, and not being fine enough to prevent young salmon from passing through are, therefore, a useless expense.

FIG. 3.—Rainbow trout, female.

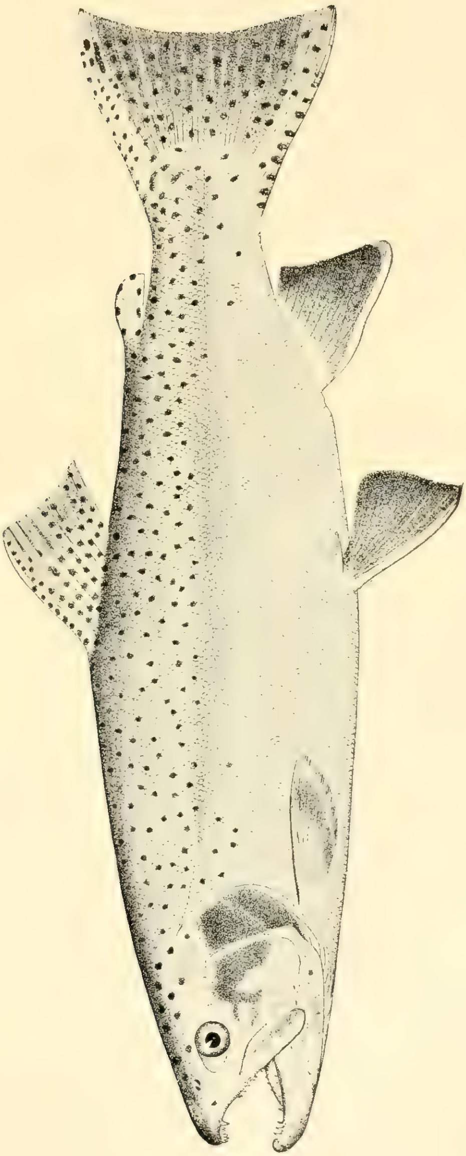
16. Rainbow Trout. *Salmo irideus* Gibbons.

Plate x and fig. 3.

Head 4.66 in length without caudal; depth 3.50; eye 4.66 in head; snout about 4; dorsal 11; anal 11; scales 21–135 to 140–20.

Head short and deep; snout short; mouth large, maxillary not quite reaching to below posterior margin of eye; vomerine teeth in 2 irregular rows; body short and deep; caudal peduncle rather deep, about 2 in head; dorsal origin a little nearer tip of snout than base of caudal; length of dorsal base 7.5 in length of body without caudal, slightly exceeding longest ray; last dorsal ray 2 in longest; anal base a little less than 2 in head, the longest ray about equaling longest dorsal ray.

Upper parts greenish blue, sometimes purplish; sides more or less silvery, and profusely spotted with small black spots which are most numerous above the lateral line; head, dorsal, adipose, and caudal also black-spotted. In the spring breeding season the broad crimson lateral band becomes brighter, and the sides of both sexes are iridescent purplish. (After Bean.)



RAINBOW TROUT. MALE. (*Salmo irideus.*)

Rainbow trout is the name in most general use for this fish. Other names are chiefly those of localities in which the trout or its varieties occur. It is a native of the mountain streams of the Pacific coast, occurring from California to Central Alaska. It is not native in the East, though in some of the states it has become fairly well acclimatized. It does not, however, seem to have been successfully established in New Hampshire. There are unauthentic reports of its having been taken in upper Connecticut waters, the most positive being that of Mr. Bumford, who said that several years ago he placed rainbow trout in East Inlet of Second Lake, and landlocked salmon in Third Lake, and that five years ago he saw 2 rainbows caught in a pool below First Lake dam, one of them weighing 5 pounds.

The following plants of rainbow trout have been made in the Connecticut lakes. It could not be ascertained whether fry or fingerlings were planted or in what particular waters they were placed:

1895	20,000	1901	25,000
1896	20,000	1902	25,000
1901	50,000	1904	18,000

According to Bean "the average individuals of this species are less than a foot in length, but specimens measuring more than 2 feet and having a weight of 13 pounds have been recorded. At Neosho, Mo., the young have been artificially grown to a length of nearly a foot in a year."

The rainbow trout feeds on worms, insect larvæ, and salmon eggs. In streams in which the California salmon and rainbow exist together, the rainbow is more destructive to the salmon eggs than any other species. Spawning takes place in winter and early spring, varying with temperature and locality. The bulk of the eggs are usually taken in January, February, and March, and the average yield from each female is about 900 eggs. A few of the females spawn when 2 years old, but about one-half of them begin at 3 years. The egg is from one-fifth to two-ninths inch in diameter; it has a rich cream color when first taken, changing to pink or flesh color before hatching.

This species will live in water of a much higher temperature than the brook trout will endure and it thrives in tidal streams and even salt water.

The rainbow trout is a lively and acrobatic game fish. It is preeminently a fly fish and a good-sized one on a light fly rod will tax the skill of the angler and cause more of the proverbial ecstatic thrills than almost any fish of its size, excepting perhaps the steelhead, which, by the way, might be more successfully cultivated and acclimatized in New England waters than the rainbow, as it has become well established in the cold waters of Lake Superior.

The rainbow is highly esteemed as a food fish.

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17. Brown Trout. *Salmo fario* Linnæus.

Head 3.8 in length; eye 5 in head; snout 3.7; distance from tip of snout to end of maxillary 1.8; distance from tip of snout to end of maxillary bone 2.35; gillrakers 5+11; branchiostegals 10; dorsal 10; anal 9; longest dorsal ray 1.5 in head; longest anal ray 1.6; longest pectoral ray 1.44; scales 140.

Body comparatively short and stout; head moderate; eye small; mouth large; maxillary reaching beyond eye; caudal peduncle deep, about 2.5 in head; origin of dorsal fin slightly nearer tip of snout than base of caudal, its outer edge straight; caudal fin nearly truncate, slightly emarginate in small examples; anal similar to dorsal, its posterior base directly under posterior base of adipose fin; origin of ventrals under last third of dorsal, tips not reaching vent; pectoral moderate, falcate.

General color in life, top and side of head and back as far down as lateral line light olive with metallic lustre; side of back and side, as far as lateral line, with black and dark brown spots; top of back without spots; below lateral line to level of ventral fins light olive and light golden yellow; belly white; large black spot on preopercle and several smaller black spots on opercle; along sides, immediately above and below lateral line, light orange spots, ocellated

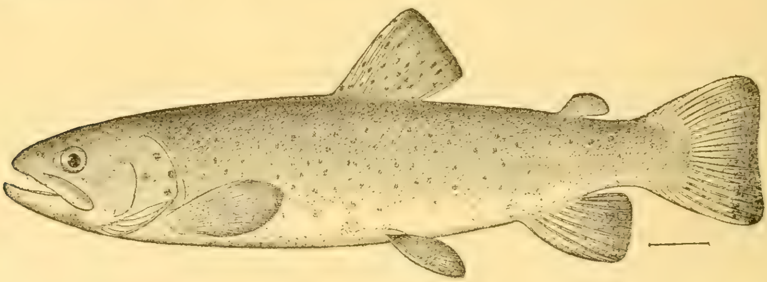

Fig. 4.—Brown trout.

with very pale blue; dorsal fin with numerous black spots, fin grayish olive, tip of first 3 or 4 rays lighter gray; other fins yellowish olive; first ray of anal white, margined posteriorly with dusky streak; no spots on caudal; adipose fin plain; tips of jaws dusky; throat and under part of lower jaw white; parr marks evident at times, about 11 in number; very faint large dusky spots below posteriorly.

Description from male specimen 9 inches in total length.

Distinguished from the common trout by having spots on the back instead of wavy markings or rivulations, and the vomer with teeth on the shaft, not in a group at the head as in the common trout. Distinguished from salmon by the presence of white margins to ventral and anal fins.

The "brown trout," "German trout," "German brown trout," or "von Behr trout" is the common brook trout of Europe. In Great Britain it is the "brown trout" or "yellow trout." It was introduced into this country from Germany in 1883, according to Bean[a], through the instrumentality of Herr von Behr, president of the Deutscher Fischerei Verein:

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[a] Bean, T. H. Fishes of New York. Bulletin 60, New York State Museum, 1903, p. 256.

It is now well established in New York, Pennsylvania, Maryland, Missouri, Michigan, Wisconsin, Nebraska, Colorado, and several other states. This trout has proved to be well adapted to the region east of the Rocky Mountains, which has no native black-spotted species, though the western streams and lakes contain many forms in a high state of development.

Size.—Under favorable conditions the brown trout has been credited with a weight of 22 pounds and a length of 35 inches. In New Zealand rivers, where it was introduced with unusual success, it now approximates equal size; but in most localities 10 pounds is about the limit of weight and 5 or 6 pounds is a good average, while in some regions the length seldom exceeds 1 foot and the weight ranges from one-half to 1 pound. In the United States a wild specimen, 7 years old, weighed about 11 pounds. In a well in Scotland an individual aged 15 years measured only about 1 foot in length. These illustrations will serve to show how much the growth of a brown trout is affected by its surroundings and food supply. The species has been known to become sexually mature when 2 years old and 8 inches long.

Habits.—The brown trout thrives in clear, cold, rapid streams and at the mouths of streams tributary to lakes. In its movements it is swift, and it leaps over obstructions like the salmon. It feeds usually in the morning and evening, is more active during evening and night, and often lies quietly in deep pools or in the shadow of overhanging bushes and trees for hours at a time. It feeds on insects and their larvæ, worms, mollusks, and small fishes and like its relative, the rainbow trout, it is fond of the eggs of fishes. In Europe it is described as rising eagerly to the surface in pursuit of gnats and is said to grow more rapidly when fed on insects.

Reproduction.—Spawning begins in October and continues through December and sometimes into January. The eggs are from one-sixth to one-fifth of an inch in diameter and yellowish or reddish in color; they are deposited at intervals during a period of many days in crevices between stones, under projecting roots of trees, and sometimes in nests excavated by the spawning fishes. The parents cover the eggs to some extent with gravel. The hatching period varies according to temperature from forty to seventy days. Females aged 3 years furnish on the average about 350 eggs each, but individuals of this age have yielded as many as 700, and even at the age of 2 years some females produce from 400 to 500. When they are 4 or 5 years old, the number of eggs has reached 1,500 to 2,000. The young thrive in water with a temperature of about 50° F. Sterility in the females is common, and the breeding females have been observed to cease reproduction when 8 years old.

Qualities.—The brown trout is in its prime from May to the last of September. Its flesh is very digestible and nutritious, and deeper red than that of the salmon when suitable food is furnished; the flavor and color, however, vary with food and locality. Insect food produces the most rapid growth and best condition. This species has been so long known as one of the noblest of the game fishes and its adaptability for capture with artificial flies because of its feeding habits is so well understood that I need not dwell on these familiar details.

This species was introduced into Connecticut Lakes as follows: 1894, 20,000; 1901, 170,000. Although the precise locality is not certain, it was probably in Mud Pond Brook. It is uncertain whether all of those collected are the individuals planted or some or all of them offspring of the planted fish. The great difference in size would seem to indicate that at least the small ones were offspring

or the second generation. The specimens run from about 4.25 to 9 inches in length. The food, as indicated by the stomach contents, consisted of small insects and caddis worms or larvæ with wood and fine gravel cases. Individuals about 5.75 inches long were sexually mature males and one about 6 inches long a female with eggs.

Should further plants of this fish be made in the Connecticut Lake waters it is suggested that they be restricted to the immediate waters of the First Lake, and that they be placed in the lower end of Coon Brook near Main Inlet and in Big Brook near the road to Second Lake. Both of these places can be conveniently reached, the one by boat, the other by team. The advantages of these places are that owing to the tendency of the trout to remain in the waters in which planted it would attain a larger size in these brooks and perhaps would be more likely to work out into the Main Inlet and thence to the lake, where it would reach a still larger size.

17. Lake Trout. *Cristivomer namaycush* (Walbaum).

Plate xi.

Head in length to base of caudal 3.79; eye in head 7.58; snout 5.05; maxillary bone 2.45; mandible 1.59; gillrakers 8+13 on each side; the longest about 1.7 in eye; branchiostegals 12 on right side and 11 on left; dorsal 11; anal 10; scales 32–180–32.

Head comparatively long; eye small; distance from tip of snout to posterior extremity of maxillary 1.97 in head; body rather more slender than that of the trout or salmon; pores of lateral line about 120 in number; pectoral moderate, 1.68 in head; first rays of dorsal and anal longest, much overlapping the others when depressed, especially in the anal; caudal deeply forked.

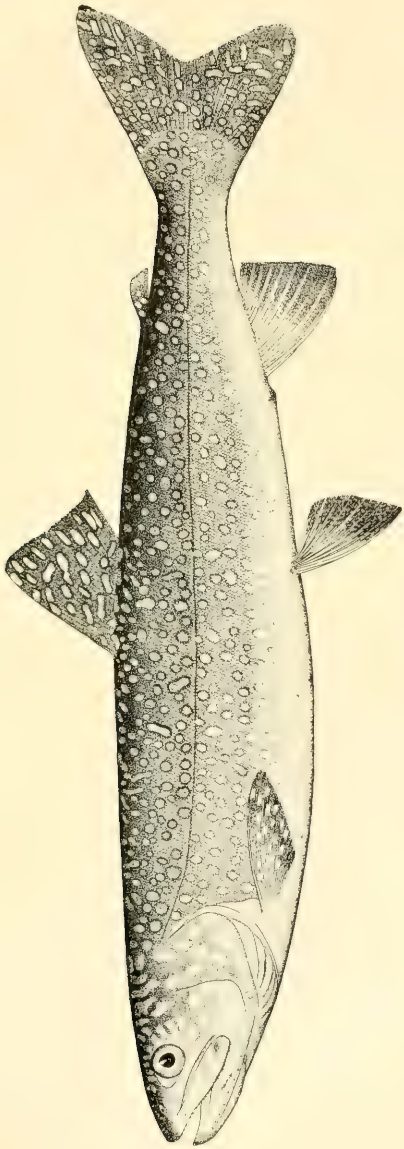
Head, back, and upper parts of side dark greenish gray, the color most intense on edges of scales, clearly defining their outline; belly silvery white with darker shade defining margins of scales; light golden yellow spots on cheeks and opercles and all parts of body except ventral region, from tip of lower jaw to base of anal, the spots lighter posteriorly; dorsal olive, spotted with pale yellow and broadly margined with same shade; pectoral and ventrals pale yellow below, dusky above with broad margin of pale yellow; anal dusky, with ends of rays pale yellow, first rays white; adipose and caudal dusky, spotted with greenish yellow. Description taken from a male specimen 15.5 inches long caught in Second Connecticut Lake, September, 1904.

A specimen 11.25 inches long caught at the same time, also a male, has a longer head, larger eye, longer snout, and somewhat longer fins. The color often varies from very dark, almost black, with dull yellowish or soiled white spots, to bright silver with more sharply defined, cleaner spots of white, gray, or yellow.

Other individuals vary somewhat from the above descriptions according to age, sex, breeding condition, and the water in which they occur.

Distinguished from all other trout or salmon by its color and sharply forked tail.

The lake trout is known most commonly in this region by the name of "laker" or "lunge." In Maine it is frequently called "togue" and in parts of New Brunswick "tuladi," and erroneously in other



LAKE TROUT (*Cristivomer namaycush*).

places salmon trout. In the Great Lakes it is "namaycush," "Mackinaw trout," etc. As "Mackinaw trout" it has been introduced into the Connecticut Lakes, although the same species was indigenous to those waters.

The lake trout is common over the northern part of the United States as far west as Lake Superior and extends northward to the Arctic regions. It occurs also in the Columbia and Frazer rivers and on Vancouver Island, but in very limited numbers. In the Report of the Fish and Game Commissioner of New Hampshire for 1892, page 77, it is stated "that this excellent food and game fish [*Salvelinus namaycush*] is indigenous to only six of our lakes, viz, First and Second Connecticut lakes, Squam Lake, Winnepesaukee Lake, including Winnisquam Bay, New Found Lake, and East Pond in Enfield." No adults were secured in First Lake, but in Second Lake some were taken.

This fish is a frequenter of deep water, especially in the summer time, approaching the shore or shoals at times for food, and in the fall for spawning. It is a voracious feeder when it feeds, but like other members of the salmon family it has its caprices, or at least, periods when it will not take a hook. It eats small fishes of almost any kind. Its spawning time is in September and October. Bean says (op. cit.) a female of 24 pounds carries about 14,943 eggs, but not over 5,000 and 6,000 as commonly found, and after the trout has attained maturity at 3 years of age, 1,000 eggs to the pound of fish may be accepted as a general rule. The eggs do not hatch until spring, when the waters begin to warm.

As a game fish it is not remarkable and it is inferior as a food fish. Opinions and tastes differ, however, regarding these qualities. The usual method of capture is by trolling in early summer, at other times by still fishing with live or cut bait. Cut chub is considered a good bait, and sometimes these morsels will be taken in preference to a whole minnow or shiner. The lake trout seldom takes a hook between the last of June and first of September. This habit of refraining from gratifying the angler or fisherman in summer while the water is above a certain temperature, the degree of which is not definitely known, is common to other members of the salmon family.

The records of the introduction of this fish into Connecticut Lakes, under the names of lake trout and Mackinaw trout, are as follows:

1893	100,000	1898	8,000
1894	25,000	1903	25,000
1895	100,000	1904	25,000
1896	80,000		

Young of this species, which may be some of those recently planted, or perhaps naturally hatched, were found in small tributary brooks of First Lake as follows:

July 16: In a spring rivulet tributary of main inlet not far above its mouth, several were caught, 2 of which, 2.37 and 2.08 inches long, respectively, were saved. Their stomachs contained blackfly larvæ, insect fragments, and insect eggs.

July 18: In the same rivulet another specimen 2.08 inches long was taken. Its stomach was empty.

August 10: In Alder Brook, directly tributary to the lake, 4 were caught, measuring 2.08, 2.06, 2, and 1.87 inches long, respectively. Their stomachs contained blackfly larvæ, insects (head and wings), and mosquitoes.

18. Trout. *Salvelinus fontinalis* (Mitchill).

Plate XII.

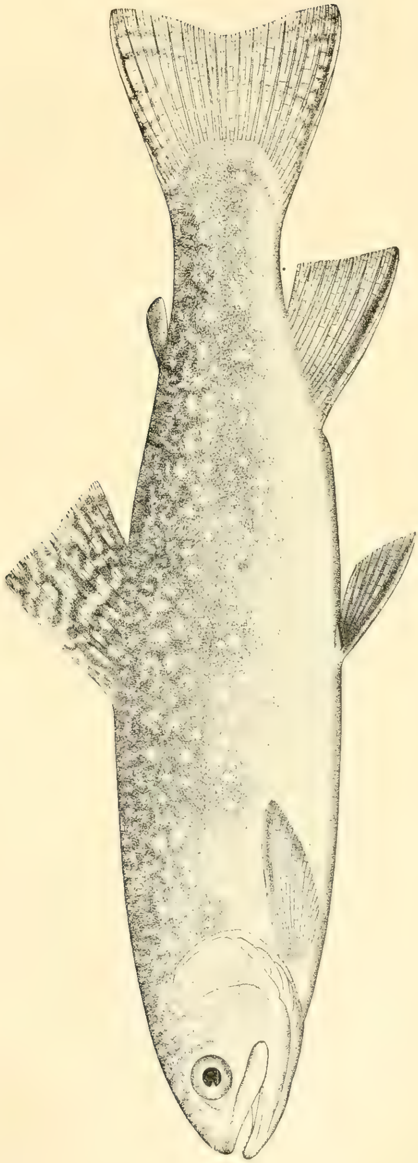
The trout is so well known and varies so much in structure, shape, and color, that a detailed description is hardly necessary. But for comparison with the small brown trout a brief outline of the distinctive characters is given, drawn from a male specimen, collected at the same time and place as the brown trout. It is a typical "brook trout," 6.66 inches long.

Head 4.42 in length without caudal; depth 3.42; eye 5.25 in head; snout 4.20; maxillary bone 1.9; branchiostegals 10 on right side and 11 on left; gillrakers very short and rather stout, 6+10 on each side; dorsal 9; anal 8; scales about 225. Head bluntly conic, mouth rather large, distance from tip of snout to posterior extremity of maxillary 1.61 in head; mandible 1.44; eye moderate, distance between the eyes rather broad, 3.23 in head; body rather slender, slightly compressed; lateral line with about 118 pores; caudal peduncle rather deep and compressed; dorsal moderate, when depressed the tips of first rays not nearly reaching tips of last, 2.25 in head; base 2.1; anal falcate, the first rays longest, 1.61 in head, when depressed reaching far beyond the tip of last rays, base 2.62 in head; pectoral moderate, 1.68 in head; ventral 1.9.

Head and body to some distance below lateral line brownish olive; vermiculated on top of head and back with yellowish markings; sides iridescent, bluish and green, with large yellow spots and some smaller red spots surrounded with pale blue aureola; lower jaw creamy white; throat and branchiostegals dusky; belly much punctulated with dusky, causing an irregular clouding, conforming somewhat to the dark parr marks, 7 of which cross the sides; lower three-fourths of dorsal with large black spots arranged in irregular rows, sometimes coalescing, giving, with the lighter ground color, a vermiculated appearance to the latter; upper margin of fin straw with indistinct spots; pectoral, ventral, and anal orange, with first ray white, bordered by black within: adipose dusky, tipped with yellow; caudal orange and olive, finely barred with wavy marking.

This fish is very generally known as "trout." Sometimes to distinguish it from the laker it is designated as "squaretail," and from black-spotted fish of the salmon family as "redspot." It is also called "brook trout," especially when occurring in brooks. "Speckled beauty" is a pet name almost too hackneyed for repetition here, and "speckled trout" is not distinctive.

This trout is indigenous to most suitable waters from Nova Scotia to Labrador, throughout New England, northern New York, and the Great Lakes region, west to the Saskatchewan, and in the moun-



TROUT (*Salvelinus fontinalis*).

tains south to Georgia. It occurs to some extent in all the waters of the Connecticut Lake region that were examined. It is not common in First Lake, but is more numerous in Second and plentiful in Third Lake. Every stream and pond in the region contains more or less trout, varying in size according to the body of water and in number according to the accessibility and ease with which the water is fished. Many of the little mountain brooks literally teem with small trout, frequently too small to be legally caught, yet some of them are adult fish and probably will attain no larger size. Small brooks, of whatever character, from mountain rivulets to sluggish bog brooks, seem to contain trout. Hundreds of these trout are caught every year, and it is a question whether any harm is done thereby, for while a few may reach the lakes or river and become large fish, most of them remain in the brooks, reach maturity, and spawn while still small fish.

There is an unaccountable scarcity of trout in First Lake. Apparently the food supply, depth, and coolness of water are well suited to the fish. The small tributary brooks contain some trout, and some are caught at the proper season every year in Main Inlet. It is possible that the lake has not recovered from an early excessive destruction of fish. No facts could be elicited regarding the capture of fish in previous years in these waters by net or night line, or by spear or net on the spawning grounds, but that there was more or less of such fishing is certain.

Round Pond contains trout in considerable numbers, up to 1 or 1.5 pounds in weight at least, but they are not always to be had at the asking or fishing. Even Mud Pond, so palpably unsuited to the fish, is inhabited by some, and Unknown Pond yields large fish, up to 4 or 5 pounds it is said, but they are hard to catch, owing to the shallowness and the clearness of the water.

Second Lake has more trout, some of which are of good size; 3 or 4 pounds is not the limit in weight. Many trout are caught in East Inlet, especially above the dam. At times during the season fine large trout are caught just outside or within the mouth of Main Inlet. Smaller trout occur in fair numbers all along the inlet to Third Lake. The other inlets to Second Lake at times contain some trout and occasionally good fishing is found just off their mouths in the lake.

Third Lake is the best of all. Trout are numerous, of excellent size for the table, and gamy enough to satisfy the most fastidious. Their activity in the water and delectability on the table compensate for any deficiency in size. There are some large trout in Perry Stream, but fewer in Indian Stream. Toward the heads of both streams trout are more numerous and smaller than farther down.

Some of the habits of the trout are well known, but its caprices are little understood. In this respect it is too much individualized to

permit of much generalization. The habits necessarily vary with the habitat, also with the size of the fish. It may be said, however, that by nature the trout is a denizen of cool water. It is carnivorous and almost omnivorous within carnous limits, levying upon nearly every class of animal, worms, mollusks, crustaceans, insects, batrachians, fishes, birds, and mammals. It will eat its own eggs and young as well as those of other fishes. We have never known a trout to eat a frog or a tadpole, but have found in its stomach the next thing to it, the common water-newt (*Diemyctelus viridescens*), and have caught trout with a land-newt (*Plethodon erythronotus*) as bait. The main food supply of young trout is insect larvæ, insects, and other small invertebrates; a list of the insects and other things that have been found in trouts' stomachs would "fill a book." But the trout does not feed at all times. In most waters its feeding times are usually morning and early evening; apparently it does not feed much, if any, during warm sunny days, but if at all on such days, in the cool of the evening. It is probable, as is indicated by its behavior toward anglers, that it does not feed at all in warm bodies of water during the latter part of the summer. It ceases to bite at the advent of warm weather and begins to bite again on the first cool days of autumn.

The following notes present some of the more important observations upon the food of the trout of these waters:

June 30, Second Lake: One trout 12 inches long contained a number of chub minnows (*Couesius plumbeus*).

July 6 and 7, Mud Pond Brook near First Lake: A trout 6 inches long had in its stomach a blob (*Cottus gracilis*) 2.5 inches long, a dragon-fly larva, and a worm; still another had been feeding upon insects and insect eggs.

July 21, in small spring inlet of Mud Pond: Five trout, 6.04 to 6.91 inches long, contained flies, caddis larvæ in cases, and fragments of other insects, and 2 contained 4 and 5 seeds of the yellow pond lily, respectively, and some algæ and confervæ.

August 18, Third Lake: Trout measuring from 10.75 to 13.25 inches long had most of them been feeding upon some fine stuff with which the water this day was thickly permeated. It was a minute living organism the nature of which could not be determined. That the trout were feeding upon this may account for the fact that no trout were caught until evening. One contained a piece of backbone of some small fish, another had fragments of insects.

August 29, Second Lake: A 14-inch trout contained a partly digested chub minnow.

The only intestinal parasites observed were in a small trout from Mud Pond Brook near First Lake which contained a thread worm (nemertean) and in a 13.25-inch trout at Third Lake which was full of tapeworms (*Bothriocephalus*).

The breeding time of the trout varies somewhat with the locality and climate, and temperature of the water in which it lives. The spawning season may be from the last part of September to December. In this region it probably varies also with the particular locality, whether small pond or brook, lake or stream. Although we made no observations in this direction, fish examined indicate that they would probably spawn in October. As is well known, trout spawn in shallow water on fine gravel beds in which they make a small hollow as a nest. The spawning beds may be a shoal in the lake or in some stream which the fish ascends for the purpose. The eggs are not all emitted at one time, but a female trout, usually attended by one and the same male, occupies the nest for several days. The eggs do not hatch until the following spring. The sexes differ much in appearance at this time, especially in large fish. The head of the male is longer, the lower jaw sometimes hooked, the mouth and teeth larger, and the coloration is more brilliant, the belly and some of the fins often being a brilliant red. The body of the male, too, has a thick coat of mucus, almost or quite obscuring the scales.

Under favorable conditions trout grow rapidly, but there is no way of answering definitely the frequent interrogation, How long does it take a trout to grow? According to circumstances a trout may attain in 2 years only 3 or 4 inches in length, or it may attain 10 or more inches. Under certain conditions, as in circumscribed localities like a small brook, trout often reach maturity when only 4 or 5 inches long and still bearing the marks of young fish. Again, mature trout have been seen of not over 5 or 6 inches in length in which these marks of youth had nearly or quite disappeared, and the male fish was a facsimile of its larger brother of the lake. We have also seen in lakes of considerable size trout 9 and 10 inches long still immature.

The food and game qualities of this fish are so well known to most residents and tourists in northern New England that it is unnecessary to say much on these points. Trout vary in these respects in different waters and also, of course, with the age of the fish. Trout 9 or 10 inches long with pink flesh, from a cool stream or lake, of which the previously mentioned Third Lake trout are examples, come very near to being the proverbial "dish fit for a king." The cause of the pink or reddish flesh of the trout is a much-discussed question which has not, so far as we are aware, been scientifically investigated. But we believe that the food of the fish has nothing further to do with it than its fattening effect on the fish. It is the fat in the tissues of the trout that is thus colored, and the plumper and fatter the fish, the more highly colored is its flesh. It is the flavor of the fat that gives the peculiar delicious flavor to trout so colored. A white-meated trout may be plump, but it is of leaner flesh and lacks the flavor of the other. Small trout in cold spring or mountain

brooks are usually white-meated. Food is scarce in such places. Trout otherwise red-meated lose at the spawning time the red or pink tint to the flesh and also the good flavor. The fat is utilized in the physiological process of reproduction.

The game qualities of the fish are not always commensurate with its size and are sometimes apparently in inverse ratio; the larger the trout, the less gamy. Large trout are more powerful, pull harder, perhaps, and do a vast amount of rushing about, but the rushes are short and the pulling dogged. Small trout are more dashy, and far more active, often leaping from the water and taking the fly on their downward course. Notwithstanding this, most anglers will prefer the big fellow that is going to break the record.

The variety of the food of the trout suggests that the lures may be legion, and so they are. When trout are ravenous, as they sometimes appear to be, they will take almost any lure. These occasions are proverbially when the moon is in the right phase and the wind from the proper quarter; trout are too often capricious regarding lures, sometimes taking only natural bait, and that of certain kinds, sometimes accepting only certain artificial flies, sometimes taking troll or bait only in the spring, fly in early summer, accepting nothing for a following period, then taking fly again, or bait. The habits along these lines are many and variable. One rule or set of rules will hardly suit any two bodies of water.

In 1899 100,000 trout fry were delivered at Pittsburg, and in 1903 20,000 more were sent there, all of which were presumably planted somewhere in Connecticut Lakes.

19. Smelt. *Osmerus mordax* (Mitchill).

Head 4.24 in length without caudal; depth 5.8; eye 4.16 in head; snout 4.16; maxillary bone 2.77; dorsal 10; anal 16; scales 66–11.

Head rather pointed; mouth large, with sharp teeth on jaws, tongue, vomer, and palatines; distance from tip of snout to posterior extremity of maxillary 2.22 in head; lower jaw projecting, mandible 1.92 in head; eye large, gill-rakers slender, 12+22 in right side, 12+23 on left, the longest 1.5 in eye; body moderately deep, slightly compressed; lateral line incomplete, consisting of about 15 pores; pectoral slightly rounded at the tip, outer rays longest, 1.31 in head; ventral triangular, squarely truncate at posterior end, 8 rays; margin of dorsal straight, first rays longest, 1.47 in head, when depressed overlapping the last rays; adipose small and narrow; caudal forked; everywhere covered with white tubercles, conical except on sides of body, where they are elongate.

Top of head, snout, and front of lower jaw black; back light greenish, thickly punctulated with black; sides silvery, with few dots on margins of scales; cheeks and opercles thickly dotted; belly white, somewhat silvery, lateral stripe overlying an indefinite, dusky stripe composed of an aggregation of dark dots, most distinct posteriorly; dorsal transparent, finely dotted; caudal olive greenish, thickly dotted; pectoral pale with dotted outer rays; ventrals and anal plain or with very few dots.

The above description is from a spent male 5.25 inches long from Massabesic Lake, New Hampshire, April, 1904. The identity of these smelts with the marine form is a question which must remain unsettled until a large series from many localities is studied; they are all provisionally called *Osmerus mordax*. And because there is so much variation in fresh-water smelts, especially in those from different localities, due chiefly to size, and also because it is likely that smelt, if existing at all in the Connecticut Lakes, are small, we give a description of a smaller individual, a spent male 4.37 inches long, selected from a lot collected in April, 1904, in Sunapee Lake, by Hon. Nathaniel Wentworth, chairman of New Hampshire Fish and Game Commission. The smelt was introduced into Sunapee Lake from Lake Winnepesaukee.

Head 5 in length without caudal; depth 8.09; eye 4.20 in head; snout 4.20; maxillary bone 2.62; dorsal 9; anal 14; scales 61-9. Head pointed; mouth large, with fine sharp teeth; lower jaw projecting; mandible 1.75 in head; distance from tip of snout to posterior extremity of maxillary 2.1 in head; gillrakers very slender, 12+22 on right side, and 12+23 on left, longest 1.42 in eye; body very slender; dorsal high, first rays longest, much longer than the base and much overlapping tips of last rays when depressed, 1.4 in head, base 2.62; pectoral long and pointed; caudal deeply forked, lower lobe the longer.

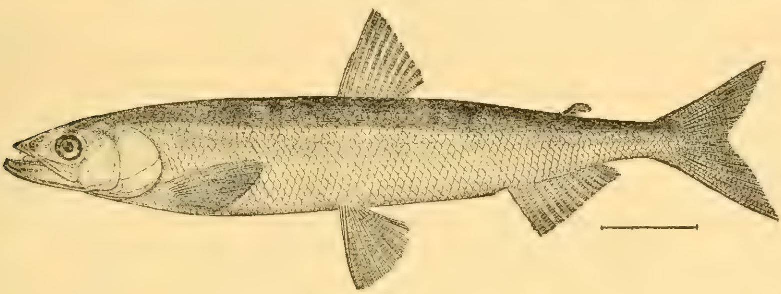


Fig. 5.—Smelt.

Top of head and back greenish, thickly punctulated with black, mostly on edges of scales; silvery on side below axis of body, with few black dots on edges of scales; ventral region plain white; dorsal transparent, finely dotted with black; caudal dusky from the many black dots; few dots on side of head, mandible, and throat; pectoral and ventrals pale, with few black dots on outer rays; anal pale with one black dot at base of each ray, a corresponding row on body at base of fin.

Distinguished from all other species of this region except those of the salmon family by the adipose fin; from all trouts, salmon and the laker, by the plainer coloration, and from the somewhat similarly colored "billfish" (and other whitefishes) by the large mouth and sharp teeth.

The smelt is universally known by this name and a few others. In Lake Champlain it is called the "icefish." Its salt-water range is from New Jersey north at least to the St. Lawrence River. The fresh-water smelt is thought to be the same species as the marine form, residing permanently, or landlocked, in fresh water. It occurs naturally in many coastwise lakes of Maine and New Hampshire and in lakes Champlain and Memphremagog but not in the Connecticut Lakes. It has been successfully introduced, however, into these and

other fresh waters, where it has multiplied exceedingly. In fresh waters the smelt varies from a few inches in length to a much larger size than is usual in salt water. In some Maine lakes it has been caught weighing over three-fourths of a pound, and there are unauthentic reports of even larger ones.

In 1898, 100,000 smelt eggs were placed in First Connecticut Lake waters, but the results of the plant are uncertain. It is maintained by some that smelts are now so abundant as to furnish so great a food supply for salmon and lunge that they will not often take a hook, and that the few caught are gorged with smelts. Others state that in the spring large numbers of small fish have been seen in Main Inlet and still others have observed schools of smelts moving about the lake, sometimes undisturbed, at other times harassed by larger fish. We, ourselves, on a number of occasions saw the schools of supposed smelts, but were always unable to get near enough to identify them and could catch none by any means, until, by a device in the form of a small cork float and tiny gauze-winged artificial flies, which was cast among the supposed smelts in early evening, many bites were received. Only a few fish were hooked and these proved to be the gray chub-minnow (*Couesius plumbeus*) and the redfin (*Notropis cornutus*). These fish acted and maneuvered like schools of smelts that we had observed in other places when the identity of the fish was proved. So at these times it seemed possible that smelts had not bitten although present, while the other small fish accidently present had taken the fly. But one day in Third Connecticut Lake schools of fish were seen moving about almost everywhere at the surface of the water, acting identically as those of First Lake did and like the smelts first mentioned. Some of these were taken on tiny flies and were found to be *Couesius plumbeus.* There are no smelts in Third Lake. We have always found dead smelts at the surface and washed up on the shore occasionally in other waters under our observation where smelts existed, but no smelt was seen by us in these lakes. One well-informed resident and a well-known guide of this region at one time pointed out some attenuated chub-minnows and said that they were what were called smelts about here. They did look very much like smelts at first glance, but of course were easily distinguished. The guide's opinion may have been formed from having seen smelts and noting the resemblance in these fishes, so that he thought these were smelts, or it may be that these minnows are believed to be smelts. Under these circumstances we have some doubt about there being any smelts in First Connecticut Lake. The foregoing description will enable anyone to recognize the smelt should it be met with.

The smelt feeds upon small fishes and other small animals, and is a most ravenous little fish. It spawns in the spring, usually in

streams it has entered for that purpose, but sometimes along shore among grass or in overflowed meadows. The breeding time begins in some places in the last of March, even before the ice is out of the lake; at other places it occurs in April and May. The majority of individuals first appearing on the spawning grounds are males, later the females appear. The eggs are small, numerous, and viscid, becoming attached to stones, plants, sticks, etc. It is recorded that a smelt weighing 2 ounces yielded from 46,000 to 50,000 eggs.

The smelt is an excellent pan fish, but it is difficult to get small ones except on the spawning grounds; however, in many waters where small ones occur there are large ones which may be caught on hook and line, in about 60 to 100 feet of water, by using pieces of fish or small minnows for bait on about a no. 1 or smaller sproat hook. The bite is feeble and sometimes will not be detected until one becomes accustomed to it.

20. PICKEREL. *Esox reticulatus* Le Sueur.

Head 3.22 in length to base of caudal; depth 5.52; eye 10 in head; snout 2.16; maxillary bone 2.64; dorsal 13; anal 13; scales 128.

Head long, the snout long and depressed, without scales above, but cheeks and opercles entirely scaled; mouth very large, the distance from tip of snout to posterior extremity of maxillary 2.04 in head; lower jaw the longer, mandible 1.44 in head; premaxillary, vomer and palatines with broad bands of sharp strong teeth which are more or less movable; lower jaw with strong teeth of different sizes; tongue with band of small teeth; body elongate, somewhat depressed, broad anteriorly, compressed posteriorly; dorsal posterior, opposite and similar to anal, its height 2.53 in head; pectoral small, inserted low, 2.9 in head; ventrals rather posterior; caudal well forked.

Greenish with golden luster; belly yellow; side marked with reticulating dark lines and blotches; a dark band below eye, fins plain.

The above description is from a specimen 27.7 inches long weighing 4 pounds, caught in Matagamon River, Maine, August 25, 1902. The color varies much in specimens from different waters and of different sizes and ages. Smaller fish usually have the belly white rather than yellow. Young pickerel are cross-barred instead of reticulated and there is a light stripe along the median line of back from head to tail.

This species, which has been introduced in these waters, can be mistaken for no other fish in the region. From the pike it is easily told by the reticulated color markings. The pike has light spots or bars and only the upper half of the opercle is scaled. From the muskellunge it is distinguished by having the cheeks wholly scaled, and by the color marking, which in the muskellunge consists of dark unreticulated spots and short bars.

The pickerel is very generally known by this name, although in some other parts of its range it has other names such as "grass pike" and "jack." It has a pretty wide distribution in the Eastern States, but does not occur much west of the Mississippi River. Its recorded range, according to Jordan and Evermann, is Maine to Florida and Louisiana, Arkansas and Tennessee. The only locality in this region

known to us in which the pickerel occurs is in Back Lake, a tributary of the Connecticut River.

The pickerel in some waters attains a weight of 7 pounds, but its average weight is much smaller; probably 2 or 3 pounds would be the average weight of the general run of large ones.

The habits of the pickerel are in most respects similar to those of other members of the family, the pike and the muskellunge. It has an unenviable reputation for fierce voracity and destructiveness. In many places it is despised and is almost universally anathematized by anglers and fishculturists. There is scarcely a body of water in which trout once lived and where pickerel now occur that the depletion of the trout has not been ascribed to the pickerel. In many instances the fish has undoubtedly been unjustly maligned. It is true that it will eat other fish if it can get them—there are few fish that will not do this. The highly esteemed and much-lauded trout and salmon are of the same sort, and the lunge rather than the pickerel should have the appellation of "fresh-water shark." During most of the year the pickerel resorts to waters uncongenial to trout, and at all times it prefers such waters. A warm, muddy pond or stream with profuse growth of aquatic vegetation is its favorite abode; trout can not exist long in such surroundings. In weedy waters where trout manage to exist, pickerel also will thrive, but trout will lie in the cooler, clearer portions while pickerel seek the water plants and shallow water. In most instances it would seem that the pickerel is not the whole, though possibly an accessory cause, of the disappearance of trout, and that the harm done by the pickerel is overestimated. The injurious effect of pickerel upon trout and salmon is more often indirect than direct, especially when it appears in congenial waters where trout or salmon are barely maintaining themselves or are decreasing. The indirect influence is upon the food supply, and this reverts upon the pickerel itself ultimately. It is an almost invariable rule that pickerel in time, after a period of increase in number and size, begin to decrease, owing to a diminution of the food supply. The pickerel is a very desirable and worthy game fish in suitable waters, but for reasons already given its indiscriminate distribution is not advised. It eats, and in eating deprives other and better fish of food; a harmony or balance of natural conditions might by this means be upset. The same may be said of any introduced fish.

The food of the pickerel is fish and other small aquatic animals. The young feed upon insects and the aquatic larvæ of insects. It spawns in the spring and early summer, but we are unacquainted with its spawning habits.

As a game fish the pickerel is highly esteemed by many. It will not always bite, the most attractive lure being often regarded with contempt and immobility. Then, again, it will voraciously strike at

anything offered it. When hooked it seldom leaps from the water like a bass or salmon, but fights vigorously and rushes and tears about until, wearied with the struggle, it yields to the landing net or gaff.

There are many methods of fishing for the pickerel. It is trolled for successfully with any of the various artificial baits, such as phantoms, spoons, and spinners, which may be used with or without bait. Casting and "skittering" is perhaps the favorite method with sportsmen, who use a long rod or pole and casting spoon or fish or frog bait. In this method the bait may be made a whole shiner or a strip from the white belly of any fish; a whole small frog, or the skinned leg of a large one, or at times a piece of pork, red flannel, or white cloth, when nothing better is available. In fishing with artificial lures of any kind the pickerel should be struck the instant it bites; with natural bait the line should be slackened and the fish should be allowed to retain the bait until it has swallowed it or got it well into the mouth, as it usually takes the bait crosswise, then stops and works it round endwise to swallow it, and does not get the hook into its mouth until it has begun to swallow the bait.

Still-fishing with live shiner or frog is another method suitable to anglers with less strenuous dispositions. In still-fishing the shiner should be hooked through the back just in front of the back fin with the front of the hook toward the head, with care not to injure the spine of the fish. A frog should be hooked through the tip of the lower jaw and nose. Fishing through the ice with set lines and hand lines is a common pastime or occupation in many localities. The set lines are used with a "tip-up" flag showing when there is a bite. Hand-line fishing in winter is much the same as still-fishing in summer.

As a food fish the pickerel is held in esteem by many and disliked by a few. The chief objection to it is its boniness.

21. Blob. *Cottus gracilis* Heckel.

Head 3.3; depth 6; snout 3.5; eye 4; dorsal VII, 17; anal I, 10. Body slender, not compressed; head large, snout short, wide and blunt, its profile straight and rather steep from eyes to tip; mouth wide, nearly horizontal, no teeth on palatines; maxillary reaching anterior edge of orbit; eyes high; preopercular spine small, concealed, nearly straight or slightly curved upward.

Origin of spinous dorsal slightly posterior to upper base of pectoral, small, less than half height of soft dorsal and not joined to it; soft dorsal long and high, longer and higher than anal; caudal rounded; tips of ventrals not quite reaching vent; pectoral longer, reaching anterior base of anal.

Color in life, in some examples dark brownish gray, the bands almost black; others much lighter; edge of first dorsal tipped with reddish orange; lower part of 3 or 4 posterior spines dark, making a dark oblong spot, the first 1 or 2 spines also darkish for lower half of their length; anterior part of second dorsal rays each with a mottled orange appearance, though not so evident as the orange

of first fin; pectoral mottled brownish, blackish toward base, the brown entirely on rays and not on membrane. These markings evident only in the larger examples (about 3 inches), the smaller ones having all the fins nearly transparent; a slight brownish and darkish mottling sometimes showing at base or lower half of pectoral and similar marking on soft dorsal. Most of the examples show 5 or 6 dark marbled cross-bands on body, though these vary greatly and are not alike in any two examples; head marbled with narrow streaks of brown or grayish brown, this extending posteriorly sometimes the entire length of body, the bands being darker than this marbling. The colors vary greatly, no two specimens being exactly alike.

Of 10 specimens from Mud Pond Brook, ranging in length from 2.37 to 2.87 inches, the head in length to base of caudal ranges from 3.22 to 4.13, average 3.42; eye in head 3.22 to 4.50, average 3.81; length of pectoral 0.95 to 1.28, average 1.12; dorsal VII or VIII, 16 to 20; anal 10 or 11.

Distinguished from the cusk by its broader head and pectoral fins and the presence of a small spine on the gill-cover (preopercle) and the absence of barbel at tip of lower jaw.

The names of the fish are mainly characteristic of its appearance, and "millers-thumb" and "star-gazer" are obviously appropriate. It is sometimes called "brook cusk" or "rock cusk" from fancied resemblance to the cusk. It is, however, not a cusk, but a fresh-water representative of the sculpins of salt water. A good name for it would be fresh-water sculpin.

Its recorded range is streams of New England and New York, tributaries of the Connecticut, Lake Champlain, Hudson, Delaware, and Susquehanna rivers.

In some waters this species attains a length of several inches, but the majority of the individuals are small, though somewhat larger than those collected in First Lake.

It feeds mostly upon insects, insect larvæ, and other small aquatic animals, and has been accused of eating fish ova and newly hatched young. The stomachs of some collected in Mud Pond Brook, July 12, contained insect larvæ, mostly of the black fly. The blob is itself sometimes eaten by other fishes, and might make a useful bait.

The easiest method of catching it is by means of a wire minnow trap.

22. Burbot. *Lota maculosa* (Le Sueur).

Head 4.03 in length without tail; eye 9.54 in head, snout 4.06; dorsal 14–74; anal 71; scales 240.

Head depressed, rather broad; anterior nostrils each with a small barbel; chin with a long barbel; snout and lower parts of head naked; mouth moderate, the distance from tip of snout to posterior extremity of maxillary 2.23 in head; lower jaw included, mandible 2.01 in head; each jaw with broad bands of equal villiform teeth; vomer with a broad crescent-shaped band of teeth; no teeth on palatines; gill-openings wide and connected, but free from isthmus; branchiostegals 8 on right side and 7 on left; gillrakers short 1+7 on right side and 1+8 on left. Body long and low, somewhat depressed in front, com-

pressed behind; scales very small and somewhat imbedded; dorsals 2, the first short, the other long; one long anal; pectoral comparatively short, 1.72 in head; ventrals ending in filaments, 1.69 in head; caudal rounded.

General color of head and body above and on sides greenish-yellow, mottled and spotted with very dark brown; belly soiled white; dorsals, anal, pectoral, and caudal same color as body; ventrals soiled yellowish; under parts of head soiled white; some yellow on branchiostegals; iris light orange.

Description from a male specimen 18.25 inches long caught on trawl with cut chub bait in about 30 feet of water.

The burbot varies considerably in proportions and color, both individually and locally. In color some are very much more mottled and blotched and with more or less definite black spots. In 12 specimens from First and Second Connecticut lakes, ranging from 10.12 to 19.12 inches in length, and averaging about 15, the length of head in length of fish to base of caudal varies from 3.46 to 4.64, average about 4.22; the longest diameter of eye in length of head 7.28 to 9.54, average 8.25; snout 2.22 to 4.11, average 3.39; maxillary 2.12 to 2.67, average 2.29; mandible 1.61 to 2.54, average 1.94; pectoral 1.50 to 1.89, average 1.74; ventral 1.5 to 2.02, average 1.82. Jordan and Evermann give the gillrakers as about 3+6. In most of our examples the number on the short arm was 1; in one instance only were there 2; the number on the long arm varied from 6 to 9, sometimes differing by one on the 2 sides of the same individual. The branchiostegals were seldom the same on both sides of the same specimen, running 8–7, 7–6, 7–7, 7–5. The scales reached as high as 262. The number of pyloric cœca, as given by Jordan and Evermann, is 30. Bean says from 30 to 138. In our specimens the arrangement is irregular and hard to count. There were several main roots, some of which had as many as 5 subdivisions and these were again divided into 2. One specimen had 11 main clusters and 46 smaller subdivisions. In our counts we have taken the individual points; they range in number from 49 to 90. Of 11 specimens 6 were females and 5 males.

This fish is distinguished by its shape and the barbels on nostrils and at chin and can not be confounded with any other species found in this region.

"Cusk," "fresh-water cusk," "ling," "lawyer," "losh," "eelpout," etc., are a few of the many names by which this fish is known, but "burbot" is preferable. In some parts of Europe it is called "tadpole."

Wherever it occurs it is usually rather abundant, although some lakes in New England, where this fish is esteemed, are somewhat depleted. The burbot has a very wide range, extending through the northern states to the Fraser River, the Arctic regions, and Alaska. It has been reported from as far south as Kansas, although none has been found south of New York on the Atlantic slope. Most deep lakes in New England contain the "cusk." It occurs in all three of the Connecticut lakes, and small ones have been taken in tributary and neighboring waters. It seems to be common in this region.

In Maine and New Hampshire it is usually considered a good food fish, but in the Great Lakes region the fishermen despise it. Probably this is because so many are caught in fishing for more desirable species. We, personally, prefer it to the "laker." It makes an excellent chowder and is very good when cooked in other ways. In these waters it probably does not attain a weight of over 4 or 5

pounds, but in other places it is known to reach 8 or 10 pounds. In Alaska some are said to have been caught weighing 60 pounds.

The burbot affects rather deep water, approaching the shore at night to feed. It subsists to a great extent upon other fishes, their eggs and young. Very little is known of its breeding habits and life history. It probably spawns about February or March on the gravel bottoms of lakes and streams. Young from 1.9 to 2.45 inches long were taken in pools in a field on Indian Stream. We are unable to ascertain that young so small as these have been observed before. They were very delicate, died quickly, and became distorted about the head, although the water in the minnow bucket, in which minnows lived very well, was changed frequently. Their appearance was much like the adult, and easily recognized. The color was somewhat mottled olive, tip of first dorsal reddish.

Young from 2.75 to 6 inches in length were taken in East Inlet of Second Lake. The stomachs and intestines of these young fish contained a variety of things, consisting partly of fragments of insects, shells of entomostraca, mites, and larval insects, principally the black fly.

THE PLANKTON ENVIRONMENT IN THE CONNECTICUT LAKES.

By A. A. Doolittle.

The present chapter records observations made at the headwaters of the Connecticut River, in the Connecticut Lakes, upon the environment of their minute suspended animal and vegetable organisms. The exhaustive determination of all the plankton forms collected and the study of them as to quantity, life cycle, distribution, and reaction to environment must be continued and reported upon later.[a]

FIRST LAKE.

The water of First Lake was examined thoroughly during the summer of 1904 for its plankton elements, and samples were taken from the Second and Third lakes and tributary streams and ponds as opportunity offered. At First Lake during the unfrozen season the prevailing winds are from the south and west, and where they have a long sweep they have piled up beaches of sand or gravel. The open space is so great that waves of considerable power are made, sufficient, at least, to prevent the establishment of any plants in the shallow bottoms off these shores, and the formation of a harbor for littoral forms of plankton. Two places on the northern shore are, however, protected, partly by points of land and partly by a very gradually shelving bottom, so that some aquatic vegetation has become established. All the shores protected from the west or south support water plants, and those protected from both directions much more. The other shores present too broad a belt of sand or barren

[a] Assistance in the determination of the aquatic species is gratefully acknowledged as follows:

Bryophyta.—Mr. E. B. Chamberlain, of New York City.

Angiospermæ.—Mr. E. L. Morris, Brooklyn Institute Museum, Brooklyn.

Infusoria.—Dr. Geo. T. Moore, Chester, Pa.

Hirudinea.—Dr. J. Percy Moore, University of Pennsylvania.

Insecta.—Dr. A. E. Schwarz and Dr. D. W. Coquillet, and Mr. H. S. Barber and Miss Evelyn G. Mitchell of the National Museum.

Mollusca.—Dr. Paul Bartsch, Smithsonian Institution.

rocks to support much vegetation. The line of fertile soil is too far removed from the water to support the water-loving shrubs which fringe the other ponds and lakes of the neighborhood. The vegetation of the muddy shores is a heavy growth of grasses, sedges, and rushes, whose identification has not been completed at this writing.

Fixed aquatic vegetation.—The following species of plants were found established in the waters of the First Lake. Those marked with an asterisk were seen only in waters immediately adjoining. The distribution of the plants in the lake will appear in the description of the stations at which plankton was collected.

AQUATIC PLANTS FOUND ESTABLISHED IN FIRST LAKE.

Chara coronata Ziz.
Fontinalis antipyretica Linnæus.
dalicarica Bruch & Shimper.
Equisetum fluviatile Linnæus. Horsetail.
lævigatum A. Braun. Horsetail.
Sparganium androcladum fluctuans Morong. Bur-reed.
simplex Hudson. Bur-reed.
simplex angustifolium (Micheaux) Engelmann. Bur-reed.
Potamogeton amplifolius Tuckerman. Pond weed.
nuttallii Chamiss & Schlechtendall. Pond weed.
prælongus Wulfin. Pond weed.
pusillus Linnæus.
spirillus Tuckerman.
robbinsii Oakes.
Sagittaria latifolia Willdenow. Arrow-head.
graminea Micheaux.
Eleocharis acicularis (Linnæus) Roemer & Schultes. Needle rush.
**Calla palustris* Linnæus. Wild arum.
Nymphæa advena Solander. Yellow pond lily.
hybrida Peck. Red-disked pond lily.
Batrachium trichophyllum (Chaix) Bossch. White water crow-foot.
**Callitriche palustris* Linnæus.
Myriophyllum alterniflorum De Candolle. Water milfoil.
* *farwellii* Morong. Water milfoil.
**Utricularia vulgare* Linnæus. Bladderwort.

Quality of the water and source.—The water shows a very decided brownish tint, discernible in even so small a quantity as a tumblerful. The plankton net showed a surface 14 inches in diameter of soiled white color, which disappeared on the brightest days at a depth of 10 feet. The water was excellent in flavor. Tests carried out with as great care as possible showed it to be well aerated to considerable

depths. The source is in the immediately surrounding timber-covered hills or mountains. The prevailing trees are black spruce (*Picea mariana*), yellow birch (*Betula lenta*), sugar or rock maple (*Acer saccharum*), and American beech (*Fagus americana*), with an undergrowth of speckled alder (*Alnus incana*) and other shrubs and herbs of northern New Hampshire. In the aggregate there is considerable sphagnum swamp in the drainage basin contiguous to this and the neighboring lakes. The water acquires its color, no doubt, during its slow seepage through the forest and marsh land by taking up considerable organic matter in solution.

Main Inlet.—The Main Inlet for a mile and a half before entering First Lake meanders through an extensive meadow, the upper part with appreciable current, but the lower half or three-fourths mile sluggishly, with much shallow water on each side of the channel and many lagoon-like bays indenting the shore. The depth varies from 4 feet in the channel to an inch or less on the muddy bars. The stream has its temperature lowered from some cause in the last mile of its course to the extent of 2° F. Vegetation is abundant, especially in the shallower portions. Bur-reed (*Sparganium simplex* and *S. simplex angustifolium*), pond weed (*Potamogeton amplifolius* and *P. nuttallii*), needle rush (*Eleocharis acicularis*), and the yellow pond lilies (*Nymphæa advena* and *N. hybrida*) predominate.

Temperature of the water.—The temperature of the sources of supply was during the summer season the same for all streams entering from wooded land, namely 55° F., or 13° or 14° lower than the surface temperature of the lake during the greater part of the season and equal to the temperature at a depth of about 25 feet. The Main Inlet at its entrance during the mid-season was 64° F., after being cooled by the addition of cool water through seepage. The water entering from near-by springs was colder, registering 50°. The temperature of all springs rising in the mountains registered 42° at their sources. Contact with the air soon raised their temperature to 55°.

The surface temperature of the lake water underwent a change of 10° during the period of observation. It was learned that the ice broke up and left the lake May 9, 1904; temperature 32° F. On June 28 the surface registered 66° F. The maximum temperature was registered on July 19 and 20—72.5° F., which fell by September 10 to 62° F. A fall of rain accompanied by wind usually caused a lowering of the surface temperature of 1½° to 2°. The original temperature was regained, however, in twelve to thirty-six hours during the warmest part of the season. In the latter part of the season the decline of surface temperature was by these sudden drops, from which there seemed to be no recovery. South Bay had a maximum temperature of 75° F. on July 19. This high temperature is

probably due to the fact that the bay has almost no tributaries and is out of the direct currents entering and leaving the lake, while the prevailing winds drive no cooler water into the bay. Its temperature together with its greater amount of fixed aquatics would indicate a plankton of somewhat different character and quantity from the rest of the lake. Some of the shallower coves, exposed to the sun, registered as high as 80° F. on this same day. The surface temperature held with but slight lowering to a depth of 15 feet, but deeper in the later and colder part of the season. At 20 feet the temperature approximated 65° F. and at 30 feet 51° F. The thermocline lay at about 25 feet, but was not confined to a thin stratum of water. From day to day, and in different parts of the lake, the thermocline was found at different levels. The changes seem to be most closely related to the piling up of the warmer surface water under pressure of the wind and a somewhat tardy lowering of the thermocline in the lee portions of the lake. From the 30-foot level the water temperature decreased uniformly to a temperature of 46° F. at 60 feet, which was maintained practically to the maximum depth of 140 feet.

Temperature of air.—The temperature of the air shows a mean much below that of the surface of the water. The mean temperature of the air for July was 63.5° F., and for August 57° F., while the average of the surface temperature during these months was 68.4° F. and 67° F., respectively. The night temperatures show an average minimum of 18.7° F. below the average for the surface for the period from July 22 to September 1, and an average of the daily maxima 5.1° F. above the average surface temperature.

The prevailing winds were from the west and south, the former bringing fair weather and the latter clouds and rain. There was no protection in these directions, and the shape of the lake permitted a sweep of wind through one of the long axes at all times. The wind was as a rule very regular and brisk during the day, but quieting over night when from the west. The usual day breeze was 10 miles an hour. During the month of August a slight drift of wind came at night from the northeast, but it did not seem to affect the water appreciably.

The usual day breeze of 10 miles an hour caused waves to run 1 foot or more high and to form slight combs. From July 1 to September 1 the waves were rough, breaking into white caps on 24 days and continuing rough on 14 nights. Smooth water or waves of moderate height, not breaking into white caps, occurred during 38 days. On 28 nights the water was relatively smooth, and on 20 occasions the water became rough during the night. In the appended table of meteorological observations but three grades of agitation of surface are recorded. Under "smooth" are included all glassy sur-

faces, whether rippled or not. Under "waves" are included all ruffled water not breaking into white caps. Under "rough" are included all crested waves. These grades of surface present clearly marked distinctions which some forms of plankton may recognize and to which they may react.

Adjacent pools.—On the east and north shores of the large eastern expanse of the lake the sand of the beach is piled up in such a way as to impound in several places the water which may wash over from the lake or find its way into the hollows by seepage or from springs. In one of these in the northeast curve of the lake and a similar one in the middle of the north shore line the supply from springs is sufficient to cause a constant stream to cut its way through the intervening bank and enter the lake. The conditions of life in these pools are very different from those found elsewhere. The shallow expanse, almost unchanging water, and resulting high temperature, 80° F., give a peculiar flora. The pools on the east differed from those on the north. The east pools were filled with *Mougeotia* sp., *Chara coronata*, *Potamogeton pusillus*, *Callitriche palustris*, *Myriophyllum alternifolium*, and *Utricularia vulgaris*. The pool on the north was filled with *Sagittaria latifolia*, *Myriophyllum farwellii*, and *Utricularia vulgaris*. This pool remained luxuriant throughout the season, while those on the east became choked with vegetation and cleared through decomposition during the summer. The pools which have communication with the lake doubtless are a source of plankton forms loving or requiring quiet water of relatively high temperature and a dense vegetable environment.

SECOND LAKE.

Shore vegetation.—The shore line of the northern part of this lake is of small bowlders along the western shore and the tongue of land. A small portion of the eastern shore which receives the sweep of wind across the entire lake is a sandy beach. The remainder of the shore line and the shore line of South Bay is a turf. The rocky shore is characterized by royal fern (*Osmunda regalis*), sweet gale (*Myrica gale*), speckled alder (*Alnus incana*), meadow-sweet (*Spiræa salicifolia*), red osier dogwood (*Cornus stolonifera*), rhodora (*Rhodora canadensis*), sheep-laurel (*Kalmia angustifolia*), and withe-rod (*Viburnum cassinoides*), with a background of black spruce (*Picea mariana*), fir balsam (*Abies balsamea*), paper birch (*Betula papyrifera*), and yellow birch (*B. lutea*), with a very occasional specimen of white pine (*Pinus strobus*). The turf shores were covered with the grasses and sedges common to the region.

Sources.—The visible sources of water are five streams, two of considerable size—the Main Inlet, or Connecticut River, at the northern end of West Cove and a small stream at the northwest curve of

West Cove, East Inlet entering East Cove, and two small streams entering from the southeast.

The Main Inlet enters from the north after meandering for a distance of 1 mile or more through open country as a sluggish stream, 30 feet wide, and 2 to 3 feet deep. In the rapid water 1½ miles above the lake, the temperature registers 57° F.; in the lower stretches, out of reach of lake influence, the water registered 54° F. at a time when the surface of the lake was 62° F. The cooling of the water of the river, similar to that observed at the entrance of the Main Inlet to the First Connecticut Lake, is therefore to be noted. Considerable beds of chara (*Chara coronata*), bur-reed (*Sparganium simplex angustifolium*), pond weed (*Potamogeton amplifolius* and *P. nuttallii*), and milfoil (*Myriophyllum alterniflorum*) occupy the bottom, particularly toward the entrance to the lake.

The stream from the northwest meanders similarly from the hills in the distance. Its temperature was 56° F. on August 20. The East Inlet enters at the northeastern curve of the lake from the east. Its course can be traced through open country for 5 or 6 miles easterly with but few rapids among the hills which feed it. Its temperature is higher than the other inlets, due, no doubt, to its longer exposure to the sun in stretches of dead water. From the hills on the immediate east are two small streams, seeping their way to some degree through the intervening meadow.

Fixed aquatic vegetation.—The western shore is protected from the prevalent wind and consequent wave action. Here in the shallow protected water of the limnetic bench were established pond weed (*Potamogeton pusillus* and *P. spirillus*), needle rush (*Eleocharis acicularis*), pipewort (*Eriocaulon septangulare*), and water lobelia (*Lobelia dortmanna*). In East and West coves of the main portion of the lake and in South Bay were mixed beds of chara (*Chara coronata*), pond weed (*Potamogeton amplifolius*, *P. prælongus*, and *P. perfoliatus*), pond lilies (*Nymphæa advena* and *N. hybrida*), water milfoil (*Myriophyllum spicatum*), and *Batrachium trichophyllum*, all of which are plants able to root at depths below the limit of the wave action of this lake and to resist, when at the surface, some degree of roughness. The growth of these aquatics is greatest in South Bay, and only a little less dense in East Cove. In the shallower, more protected corners of the lake were occasional beds of pond weed (*Potamogeton nuttallii*), milfoil (*Myriophyllum alterniflorum*), and *Sagittaria graminea*, in addition to the omnipresent great yellow pond lily (*Nymphæa advena*). The quantity of fixed aquatic vegetation was greater in this lake than in any other of the larger bodies of water in this vicinity. The single detached specimen of *Potamogeton perfoliatus* apparently loosened in sounding or dredging indicate a flora possibly undiscovered.

Character of the water.—The color of the water of Second Connecticut Lake was the brownish tint common to these lakes. Its temperature at the surface was 2°F. higher than that of the surface temperature of First Connecticut Lake at the same time. At the bottom depth of 65 feet 50° F. was registered as compared with 46° F. on bottom at the same depth in the First Connecticut Lake. Its higher temperature is easily accounted for by its relatively greater exposure to the sun.

The conditions of this lake seem to favor a greater amount of plankton, both animal and vegetable, than First Connecticut Lake supports. The higher temperature, the lesser depths, the greater amount of fixed aquatic vegetation, and the character of the inlets seem to favor littoral forms.

THIRD LAKE.

Shore vegetation.—The shores of this lake are covered with black spruce (*Picea mariana*) and yellow birch (*Betula lutea*), with a fringe of arbor vitæ (*Thuja occidentalis*) and a scattering of the other hard-wood trees of the region. Among these trees is an undergrowth of shrubs, among which are mountain holly (*Illicoides mucronata*), sheep laurel (*Kalmia angustifolia*), withe-rod (*Viburnum cassinoides*), and stag bush (*Viburnum prunifolium*). Along the border of quiet streams were banks of sweet gale (*Myrica gale*) and rhodora (*Rhodora canadensis*), and along wooded streams the ever-present speckled alder (*Alnus incana*). Ferns of great variety, mosses, and both leafy and thalloid liverworts covered the ground, mingling with a sparse turf. Vegetation came to the edge of the water. The shore line was therefore protected by roots and turf, except portions of the western shore, which were rocky. The bottom near shore formed a narrow limnetic shelf of sand, 20 feet wide and 3 feet deep at its outer edge. The further descent is sudden and ran to the general depth of 80 feet. A maximum depth of 103 feet was found.

Fixed aquatic vegetation.—On the limnetic bench were established the seven-angled pipewort (*Eriocaulon septangulare*), the needle rush (*Eleocharis acicularis*), and the water lobelia (*Lobelia dortmanna*), and on the sudden descent at the edge pond weed (*Potamogeton amplifolius* and *P. nuttallii*). There seemed to be no other fixed aquatic plants in the lake. The shallower, warmer waters of the inlet harbored aquatic plants not found in the lake itself—horsetail (*Equisetum lævigatum*) and bur reed (*Sparganium simplex angustifolium*), and there flourished here the great yellow pond lily (*Nymphæa advena*) as well as the species of *Potamogeton* found in the lake.

The temperature of the rapid water of the streams entering from the hills was uniformly 55° F. on August 15, 1904, the same as of

similar brooks throughout the entire region. The temperature of the dead water of the main inlet rises to 65° F. near its entrance, almost to the temperature of the lake itself. The lake registered lower than any of the other bodies of water visited. On August 17, 1904, the temperatures were as follows:

Depth.	Temperature.
Feet.	*°F.*
0	66
5	66
10	66
20	65
30	52
40	45
[a] 103	43

[a] Bottom.

ROUND POND.

The shallow water of the edge of Round Pond is turfed with needle rush (*Eleocharis acicularis*), the seven-angled pipewort (*Eriocaulon septangulare*), and the white lobelia (*Lobelia dortmanna*). At places this turf yields to beds of *Panicularia fluitans* and *Eleocharis palustris*, or to rocks. In deeper water is established a bed of *Nymphaea advena*.

The height of the hills protects the lake effectually from winds and a long exposure to the sun. The temperature of the surface was that of First Connecticut Lake at the same time, due possibly to the broad shallow margin exposed to sun and air, but the temperature declined very rapidly with the depth as follows:

Depth.	Temperature.
Feet.	*°F.*
0	69
20	52
30	45
[a] 47	44

[a] Bottom.

The color of the water was brownish, but otherwise clear and of good flavor. On the whole this lake very closely resembled Third Connecticut Lake as a plankton environment.

LOCATION OF THE PLANKTON STATIONS.

First Lake.—Six permanent plankton stations were established and marked by buoys. Their positions are indicated by capital letters upon the accompanying map.

A. Depth, 80 feet; was selected as typical of the open body of the lake, and always accessible.

B. Depth, 90 feet; near the influence of rocks.

C. Depth, 80 feet; was in touch with the shallow and warm water of the outlet.

D. Depth, 140 feet; was located in the deepest part of the lake.

E. Depth, 100 feet; was chosen to secure the plankton characteristic of the large and quiet body of water lying in South Bay.

F. Depth, 30 feet; was in the environment of a sandy shore, and to secure such plankton as the Main Inlet might be pouring into the lake.

Plankton was also taken from time to time from 21 special localities, indicated by Roman numerals on the map, distributed and characterized as follows:

I. The shallow marshy area at the mouth of Mud Pond Brook, characterized by *Sagittaria latifolia* and *S. graminea.*

II. At the mouth of shallow pool on north shore, which was fed by springs, and characterized by *Myriophyllum farwellii, Utricularia vulgaris,* and *Sagittaria latifolia,* to determine what plankton was supplied from this source.

III. Mouth of Round Pond Brook.

IV. Lower reach of Main Inlet. Vegetation of *Potamogeton amplifolius, P. nuttallii, Sparganium simplex angustifolium, Eleocharis acicularis, Nymphœa advena,* and *N. hybrida.*

V. Immediately off the mouth of Main Inlet.

VI. Surface tow of open lake.

VII. Surface tow of open lake.

VIII. Surface tow in West Bay.

IX. Thirty feet of water, near shallow cove of West Bay.

X. Shallow cove of West Bay, characterized by *Myriophyllum alterniflorum* and *Nymphœa advena.*

XI. Near outlet, over 30 feet of water.

XII. Protected waters of South Bay, 15 feet deep, among *Potamogeton pusillus, P. spirillus,* and *Myriophyllum alterniflorum.*

XIII. Protected waters of South Bay, 15 feet deep, characterized by *Myriophyllum alterniflorum.*

XIV. Protected water of East Bay, sparse growth of *Chara coronata.*

XIVa. Wave pool on east shore.

XV. Water of Round Pond Brook before entering First Lake.

XVI. Dead water of Main Inlet above the lake before it enters the region of vegetation.

XVII. Rapid water of the Main Inlet.

XVIII. Water of Alder Brook.

XIX. Water of lake off Alder Brook.

XX. Bed of *Potamogeton nuttallii* in West Bay.

XXI. Bed of *Potamogeton nuttallii* and *P. pusillus* in South Bay.

Second Lake:

(*a*) In East Cove, depth 15 feet, among *Chara coronata, Potamogeton amplifolius, P. prœlongus, P. spirillus, Nymphœa advena, N. hybrida, Myriophyllum spicatum.*

(*b*) In rapid water of inlet.

(*c*) Still water of inlet in beds of *Chara coronata, Potamogeton amplifolius, P. nuttallii, Batrachium trichophyllum.*

(*d*) Various protected coves among *Sparganium simplex*, *Sparganium simplex angustifolium*, *Sagittaria latifolia*, *S. graminea*, *Eriocaulon septangulare*, *Nymphæa advena*, and *Lobelia dortmanna*.

(*e*) At various levels to the maximum depth of 65 feet.

(*f*) South Bay, depth 15 feet, in various places among same vegetation as *a* supra.

(*g*) Outlet, to see what plankton was leaving the lake.

(*h*) East Inlet, in both dead and rapid water.

Third Lake:

(*a*) On the limnetic bench, depth 2 feet, over *Eriocaulon septangulare* and *Lobelia dortmanna*.

(*b*) At various levels to maximum depth of 103 feet.

(*c*) Inlet among *Potamogeton amplifolius*, *P. nuttallii*, *Nymphæa advena*.

(*d*) Outlet, for the escaping plankton.

Round Pond:

(*a*) On the limnetic bench in 2 feet of water, over *Eriocaulon septangulare* and *Lobelia dortmanna*.

(*b*) At various levels to maximum depth of 47 feet.

(*c*) At outlet for the escaping plankton.

MACROSCOPIC FAUNA OTHER THAN FISHES.

Some aquatic or semiaquatic animals other than those belonging to the plankton came under observation as the headwaters of the Connecticut River were examined. A thorough search would multiply many times the number of species found. The following list enumerates all the species noted, but it does not attempt to give their complete distribution in these waters.

Infusorians.—*Ophrydium* sp. Quiet, warm waters of First and Second lakes.

Sponges.—*Spongilla* sp. Abundant in the shallow quiet water of inlets and pools of First, Second, and Third lakes.

Bryozoans.—*Cristatella magnifica*. Taken from rocks along shore of First Lake.

Leeches—

Dina fervida Verrill.

Glossyphonia complanata Linnæus.

Placobdella picta Verrill.

Crustaceans.—The only crustacean observed was living among sponges, an amphipod, specimen lost.

Insects—

Phryganidæ, various species, including *Helicopsyche* sp. Larvæ taken from shore rocks of First Lake.

Bittacomorpha clavipes Fabricius. Larvæ dredged in Second Lake with *Chara* and *Batrachium*.

Chironomus sp. Tubes containing larvæ and pupæ common on *Chara* and *Batrachium* in Second Lake.

Tanypus sp. Tubes containing larvæ and pupæ common on *Chara* and *Batrachium* in Second Lake.

Dryops sp. Abundant on shore rocks of Second Lake.

Mollusks—

Pelecypods—

Strophytus edentulus Say.

Anodonta cataracta Say.

Alasmidonta undulata Say.

Margaritana margaritifera L. Perry Stream and Connecticut River.

Gastropods—

Physa heterostropha Say. The Connecticut Lakes.

Planorbis bicarinata Say. The Connecticut Lakes.

Amnicola orita Say. The Connecticut Lakes.

Polygyra albolabris Say. Forests.

Batrachians—

Spelepes bilineatus Green. In small tributaries of First and Third lakes.

Diemyctilus viridescens Rafinesque. In shallow water of Round Pond and Second Lake, especially over *Eriocaulon* and *Lobelia*.

Rana virescens Kalm.

septentrionalis Baird.

clamata Daudin.

catesbiana Shaw.

Bufo lentiginosus americanus Le Conte. Toad.

Reptiles—

Thamnophis sirtalis Linn. Abundant along shores.

Turtles were seen in the First Lake inlet, at too great distance to be specifically determined.

Birds—[a]

6. *Podilymbus podiceps* Linnæus. Pie-billed grebe.
7. *Gavia imber* Gunn. Loon.
51. *Larus argentatus* Brünn. Herring gull.
58. *Larus atricalla* Linnæus. Laughing gull.
74. *Sterna antillarum* Lesson. Least tern.
129. *Merganser americanus* Cassin. Shelldrake.
133. *Anas obscura* Gmelin. Black duck.
190. *Botaurus lentiginosus* Montagu. American bittern.
194. *Ardea herodias* Linnæus. Great blue heron.
201. *Butorides virescens* Linnæus. Little green heron.
230. *Gallinago delicata* Ord. Wilson's snipe.
239. *Actodromas maculata* Viellot. Pectoral sandpiper.
256. *Helodramas solitarius* Wilson. Solitary sandpiper.
258. *Symphemia semipalmata* Gmelin. Willet.
263. *Actitis maculata* Linnæus. Spotted sandpiper.
274. *Aegialitis semipalmata* Bonaparte. Semipalmated plover.
352. *Haliaetus leucocephalus* Linnæus. Bald eagle.
364. *Pandion haliaëtus carolinensis* Gmelin. American goshawk.
390. *Cerlye alcyon* Linnæus. Belted kingfisher.

Mammals—

Fiber zibethicus Linnæus. Muskrat.

Lutreola vison Schreber. Mink.

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[a] Number and nomenclature of the American Orthnologists' Union Check List, second edition, 1905. List furnished by Mr. Edgar Tweedy, Danbury, Conn.

TABLE I.—METEOROLOGICAL OBSERVATIONS DURING THE SUMMER OF 1904 AT FIRST LAKE.

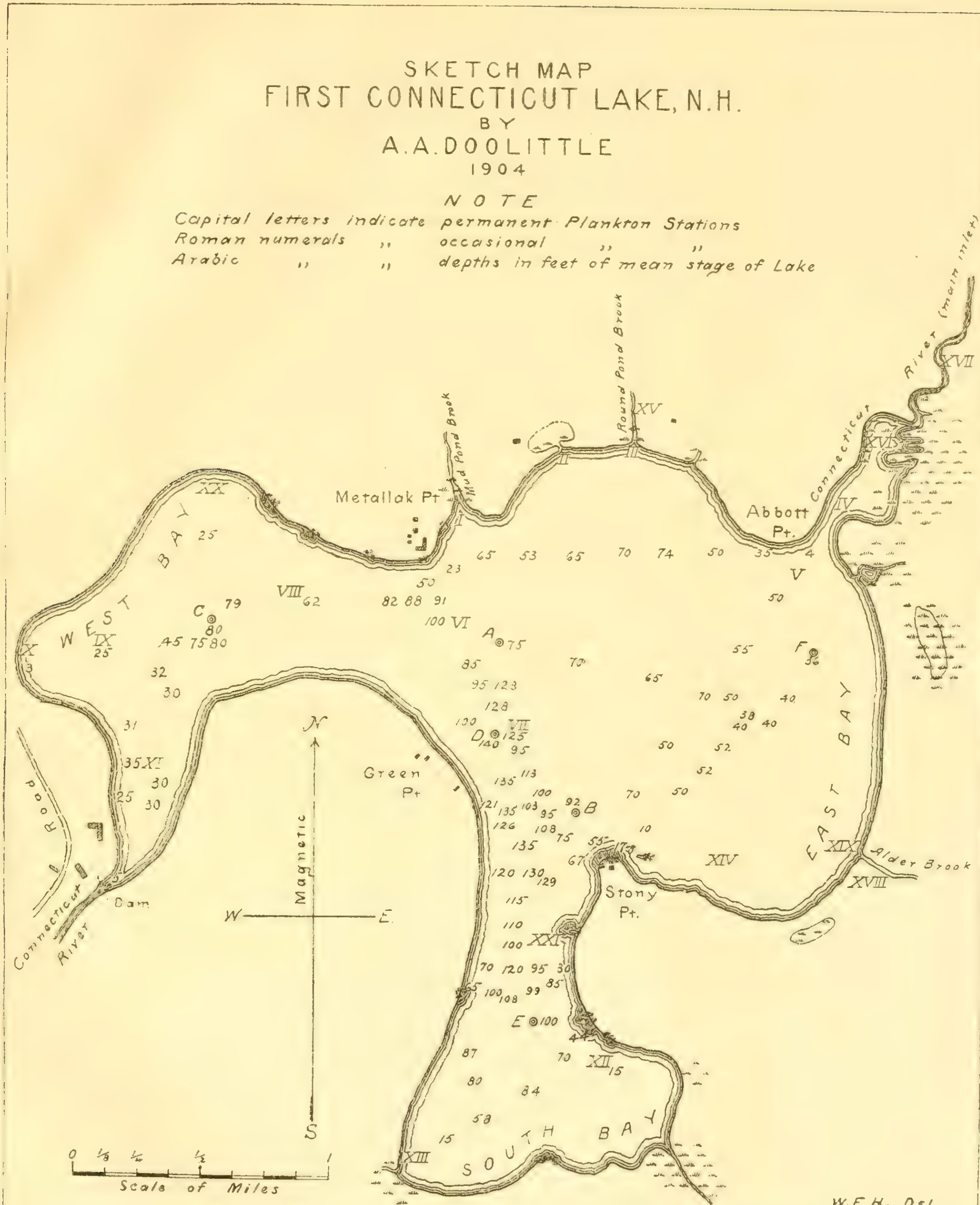
Date.	Air.					Sky.	Precipitation.	Surface of the lake water.	
	Temperature.			Wind.					
	Mean.	Maximum.	Minimum.	Direction.	Velocity per hour.			Temperature.	Condition.
1904.	°F.				Miles.			°F.	
July 1	70			S. E.	1	Clear		66	Smooth.
2	60.5			W.	1	Cloudy	Rain		Do.
3	53.5					Partly cloudy			
4	65.5			S.	10	do		66	Rough.
5	66.5			S., W., S.	1–3	do	Rain	65	Smooth.
6	63			E.	2	do	do		Do.
7	64			W.	1–2	Clear		66	Do.
8	62.5			W.	1–2	do		67	Do.
9	70.5			S.	10	do			Rough.
10	62.5			S.	6	Cloudy			Waves.
11	65			S.	1–2	Partly cloudy			Smooth.
12	69			S.	9	do			Rough.
13	55			W.	12	do	Rain	66	Do.
14	58.5			S.	4	do		69	Waves.
15	69			W., S. W.	3	do		69	Smooth.
16	67.5			S. W.	1–3	do		69	Do.
17	61			N. W.	2–3	Cloudy			Do.
18	67.5			W.	0–1	Clear		71	Do.
19	75			E.	15	Partly cloudy		72.5	Do.
20	67.5			W.	15	do		73	Rough.
21	62.5			W.	15–5	do		71	Do.
22	56.5	72	43	W.	4	do		69	Waves.
23	58.5	63	49	S. E.	4	Cloudy		69	Do.
24	61.7	70	55	N. E., S. E.	8–4	do	Rain		Rough.
25	64	72	60	E.	2	do		69	Smooth.
26	68	81.5	61	S.	1–6	do	Rain	69	Waves.
27	66	75	63	S., W.	3	Partly cloudy	do		Do.
28	66	86.5	54	S.	3–4	do	do	70	Do.
29	57	71	52	W.	5–20	Cloudy	do	69	Rough.
30	59.5	75	44	W.	1–5	do			Waves.
31	72	80	55	W., S.	4–6	Partly cloudy	Rain		Do.
Aug. 1	67.5	75	64	W.	4–8	Cloudy		69	Do.
2	62.5	78	60	W.	1–2	do			Smooth.
3	62.5	82	54.5	W., S. W.	1–2	Clear			Do.
4	63	82	45	W.	1–2	do		69	Do.
5	66	79	55	S. E., S.	10–25	Partly cloudy			Rough.
6	65	81	62	S. E.	10	do	Rain		Do.
7	57	80	53	W.	20–0	Clear			Do.
8	54	71	46	W.	5–10	Cloudy	Rain		Do.
9	53	71	41	W.	10	Clear		67	Do.
10	68.5	72	41.5	S., S. E.	10–15	Partly cloudy	Rain		Do.
11	59.5	71	57	W.	4–1	Cloudy	do	67	Smooth.
12	59.5	85	54	N., E., S.	4–1	Partly cloudy		69	Do.
13	58.5	65	49	E., S.	3	Cloudy	Rain		Do.
14	60	79	58	S.	0–4–0	do	do		Do.
15	58.5	70	55	W.	0–10–0	Partly cloudy	do	67	Rough.
16			44				do		
17							do		
18							do		
19	51.5	73	41	N. E.	4	Partly cloudy	do	66	Waves.
20	54	63	44	S., S. W.	25–40	Cloudy	do	66	Rough.
21	51	70	49	S.	3	Clear	do		Waves.
22	60.5	82	44	S.	15	Partly cloudy	do	64	Rough.
23	50	68	46	W.	4	Clear		64	Waves.
24	54.5	80	38	W.	6	do			Do.
25	68.5	80	46	S.	10	do		64	Rough.
26	48	61	47	W.	15	do		64	Do.
27	54.5	71	39	W.	10	Partly cloudy			Do.
28	58.5	70	43	W.	6–8	Clear			Waves.
29	50	63	46	W.	15	Partly cloudy	Rain	62	Rough.
30	50	69	34	W.	6	do			Waves.
31	46.5	61	37	W.	3–15–3	do		61	Rough.
Sept. 1	53	71	31	S. E.	1–7–0	do		62	Waves.
2	60.5	69	56	N. E., S.	0–3–0	Cloudy	Rain	63	Smooth.
3	64.5	71	60	S. E.	0–10	do	do		Waves.
4	59	65	54	W.	5	do	do		Do.
5	51	58	47	W.	5	do	do		Do.
6	43	65	35	W.	0–5–0	Clear		63	Smooth.

TABLE II.—TEMPERATURES[a] OF THE CONNECTICUT LAKES DURING THE SUMMER OF 1904.

Depth	July 7, First Lake, station C.	July 14, First Lake, station C.	July 15, First Lake, station A.	July 16, First Lake, station B.	July 20, First Lake, station F.	July 21, First Lake, station D.	July 26, First Lake, station E.	August 9, Round Pond.	August 11, First Lake, station D.	August 17, Third Lake.	August 24, Second Lake.	August 29, First Lake, station B.	September 6, First Lake, station B.
Feet.	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*
0	67	68	70	69	74	70	70	69	67	66	64	62	62
5	66	68	68	69	......	70	70	......	67	66	64	......	......
10	65	66	68	69	......	69	68	......	67	66	64	......	......
15	64	65	68	?62	......	68	68	......	67	......	63	......	......
20	63	62	66	65	70	66	64	52	67	65	62	62	62
22.5	58	......	57	......	......	......	......	......	......	......	......	......	......
25	57	49	54	59	66	60	57	......	62	......	59	54	61
27.5	54	......	......	......	......	......	......	......	......	......	......	......	......
30	51	48	52	52	49	53	49	45	51	52	55	51	61
40	48	47	49	48	......	50	......	[b]44	49	45	50	48	51
50	47	46	48	......	......	......	......	......	......	......	......	......	......
60	47	46	46	......	......	......	46	......	47	......	[c]50	47	......
70	......	46	46	......	......	......	......	......	......	......	......	......	......
80	......	46	46	46	......	......	46	......	46	......	......	46	......
90	......	......	......	......	......	......	......	......	......	......	......	......	......
100	......	......	......	......	......	......	45	......	46	[d]43	......	......	......
120	......	......	......	......	......	......	......	......	46	......	......	......	......
140	......	......	......	......	......	45	......	......	45	......	......	......	......

[a] The temperatures taken July 7 were of samples of water secured by the bottle method. The later temperatures were taken with recording deep-sea trip thermometer.
[b] At a depth of 47 feet.
[c] At a depth of 63 feet.
[d] At a depth of 103 feet.

O


SKETCH MAP
FIRST CONNECTICUT LAKE, N.H.
BY
A.A. DOOLITTLE
1904
NOTE
Capital letters indicate permanent Plankton Stations
Roman numerals " occasional " "
Arabic " " depths in feet of mean stage of Lake
WEST BAY
EAST BAY
SOUTH BAY
Metallak Pt
Mud Pond Brook
Round Pond Brook
Abbott Pt.
Connecticut River (main inlet)
Green Pt
Stony Pt.
Alder Brook
Dam
Connecticut River
Road
Magnetic
N
S
E
W
0 1/8 1/4 1/2 1
Scale of Miles
W.F.H. Del

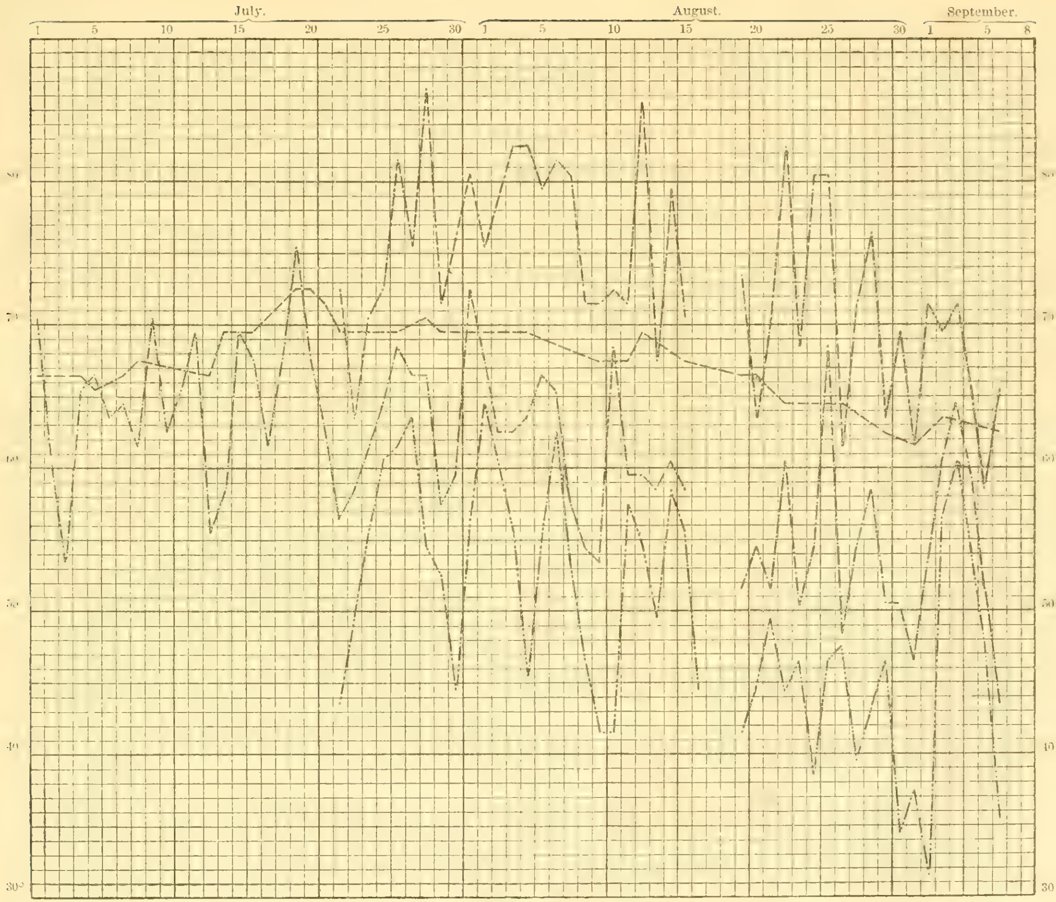


CHART EXHIBITING THE RELATION OF THE DAILY MAXIMUM, MINIMUM, AND MEAN TEMPERATURES OF THE AIR AND THE MEAN SURFACE OF THE WATER OF FIRST CONNECTICUT LAKE JULY 1 TO SEPTEMBER 6 1904.

SYMBOLS.

[Temperatures in degrees Fahrenheit.]

Mean temperature of water surface.

Maximum temperature of air.

Mean temperature of air.

Minimum temperature of air.

DEVILS LAKE, NORTH DAKOTA

A STUDY OF PHYSICAL AND BIOLOGICAL CONDITIONS, WITH A VIEW TO THE ACCLIMATIZATION OF FISH

By Thomas E. B. Pope
Assistant, Bureau of Fisheries

Bureau of Fisheries Document 634

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NORTHERN SHORE OF DEVILS LAKE.

EASTERN SHORE OF CREEL BAY.

DEVILS LAKE, NORTH DAKOTA.

A STUDY OF PHYSICAL AND BIOLOGICAL CONDITIONS, WITH A VIEW TO THE ACCLIMATIZATION OF FISH.

By THOMAS E. B. POPE,
Assistant, Bureau of Fisheries.

Since the sudden disappearance of pickerel from Devils Lake about 1889 no species of food or game fish has been found in its waters. This has been the subject of much concern to residents of that locality, and in response to repeated inquiries as to its cause and urgent requests that the lake be stocked with fish, the Bureau of Fisheries instituted investigations into the conditions now obtaining in that locality. These investigations, embracing a period of seven weeks, from July 20 to September 10, 1907, form the basis of the following report.[a]

DESCRIPTION.

Devils Lake is an irregular sheet of water 30 miles long, lying in Ramsey and Benson counties. Along its entire south shore is an unbroken ridge of prominent and typical morainal hills rising in strong contrast to the level farm land bordering its northern extent. Prior to 1889 the Mauvaise Coulée at its northwestern end maintained connection with Lake Irvine and thence through small creeks with Dry and Sweetwater lakes, directly north of Devils Lake, the whole forming a U-shaped system. At present there is neither inlet nor outlet, Mauvaise Coulée being reduced to a dry creek bed, except during the spring freshets and periods of unusual rainfall.

By reason of the rapid lowering of its level and the consequent radical changes in configuration during the past twenty-five years, Devils Lake has been broken up into detached portions or large areas narrowly connected. The most important section from an economic

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[a] The investigating party consisted of the writer, Mr. E. L. Goldsborough, and Mr. W. F. Hill, all from the Bureau of Fisheries. Residents of the locality rendered valuable assistance and numberless courtesies throughout the work.

standpoint is the larger and deeper portion—called the Main Lake—lying in the central portion of the present lake system, extending from Grahams Island on the west to the highway at the southern extremity of Roque Island on the east. This occupied the attention of the party for the major part of the investigations, though all sections and surrounding waters were inspected and observations made thereon.

A brief hydrographic survey of the Main Lake was made, a number of triangulation points being established along its shores and signals erected at favorable sites. The projection of range lines to the water's edge and the location of section corners near the lake shore were of great value in this connection, photolithographic copies of township plats bordering upon the lake being furnished by the United States General Land Office. The lines of soundings consisted of a system of transverse zigzags from shore to shore with a few lines along the axis of the lake and occasional diagonals to check results. The lines were run with the aid of small gasoline launches, soundings being taken by lead line and positions ascertained by sextant observations at about five-minute intervals. At each station temperature and density observations, water specimens, and plankton hauls were taken and recorded. The biological features of the lake received careful consideration, and collections representative of the fauna and flora were made.

The lake is located in a district of small rainfall and the excess of evaporation over precipitation has reduced the area and caused the desiccation of many shallow tributary bays. It has so decreased the depth that across the narrower portions of the lake highways have been constructed, thus anticipating the natural isolation of its component portions. Lamoreau Bay is isolated by a highway at its western extremity; from the southern point of Roque Island another public road and railroad trestle have been constructed, and these with the shallow across the narrows at La Rose Ferry divide the lake into four sections. Of these the middle section, lying between the Great Northern Railroad trestle and La Rose Ferry, is the deepest and most important. The entire western end of the old lake is now converted into barren, weed-grown tracts of land, the alkaline deposit on the soil and rocks that once formed its shores outlining its former area, and Mauvaise Coulée opens into a detached pond, the narrow irregular tributary formerly leading to it being cut off. Devils Lake city, formerly touched by the northern end of Creel Bay, is at present 1½ miles distant from the shore. The major portion of Mission Bay, an arm extending into the Sioux Indian Reservation, on the southern shore of the lake, has been entirely cut off from the parent body and is now known as Mission Lake; another portion, Large Mission Bay, is dried up; while an-

other and smaller remnant, known as Mission Bay, is practically isolated. A study of the accompanying chart shows the diminished area by comparison of the shore line charted by the United States Geological Survey in 1883 with that shown by the present investigations in 1907. The total area of the lake approximates 102.75 square miles, inclosed in a basin 40.5 miles long by 8 miles wide.

The shore line is very irregular, the character in general being similar to that of a marine littoral, bowlders, wholly or partly incrusted with a white alkaline deposit, and gravelly or sandy stretches occurring throughout its extent.

The floor of the lake is practically level, rising from a depth of 25 feet to the shallow portions near the shores or forming sand bars and stony reefs at mouths of bays. In general the deepest area is that of the southern side under the lee of the morainal ridges of Sullys Hill and Fort Totten, while the entire western section beyond La Rose Ferry is but 3 feet deep, with underlying soft black mud supporting an abundance of weeds and inaccessible to all but the lightest draft boats. West of Grahams Island the lake is almost dried up, two or three small ponds being the sole vestiges of a once broad expanse of water. The northern ends of Creel and Six-Mile Bay are desiccated and the eastern portion of the main section, at the southern end of Roque Island and contiguous to the railroad trestle, has rapidly shoaled with sand bars and reefs within 1 or 2 feet of the surface. The narrower portions of the lake are rapidly contracting and in general it may be said that it is rapidly becoming broken up into detached bodies, these in turn diminishing in size.

For purposes of this report the lake may be divided into four natural sections as follows: (1) The main section, including the deepest and most important part of the lake, from the narrow pass at La Rose Ferry to the public highway and railroad trestle of the Great Northern Railroad; (2) the eastern section, from the eastern limit of the main section to Lamoreau Bridge; (3) Lamoreau Bay, the detached extreme eastern portion of the lake system; (4) the western section, comprising all remaining water west of La Rose Ferry to Minnewaukan and Mauvaise Coulée.

MAIN SECTION.

From La Rose Ferry to the Great Northern Railroad bridge the main section extends for about 8 miles, and its greatest breadth from the mouth of Creel Bay to the wharf at Fort Totten is about 5½ miles, embracing a total area of 34.50 square miles. Into its northwestern end opens Six-Mile Bay, into its mid-northern shore Creel Bay, and into its southeastern end Little Mission Bay.

This beautiful section teemed with pickerel prior to 1889. In the "narrows" directly north of Roque Island these fish were speared and taken by hook literally by tons until their remarkable disappearance that year. They averaged 5 pounds, many individuals attaining a weight of 17 to 18 pounds. The northern end of Creel Bay beyond the "narrows" (marking the present limit of the bay) was perhaps the largest spawning ground for pickerel, though Large Mission Bay, now dried up, was also important. Six-Mile Bay shows no evidence of having furnished spawning beds, unless to a very limited area of the extreme northern end.

The maximum depth found was not greater than 25 feet. It was 35 feet in 1883, the date of the survey by the Department of the Interior. In general the bottom is composed of soft black mud, is very level, and gradually ascends to the sandy, gravelly, or rocky shores. The average density of the water in this section is 1.006.

Creel Bay.—This, the most important arm of the main section of Devils Lake, extends in a northeasterly direction for about 3½ miles, with an average width of one-half to three-fourths mile. Soundings showed an average depth of about 15 feet, with a maximum of 23 feet at the mouth of the bay. In general the shores are gravelly and rocky. Meteorological and other observations were conducted at the grounds of the North Dakota Chautauqua Association, where also was established the bench mark and tide gauge of the U. S. Geological Survey described in later pages of this report.

In this bay a remarkable wealth of plankton was obtained both in the deeper portions and along the shallow and weed-grown rocky shores, in certain localities being so abundant that the water was as if filled with sediment. A species of light-green alga attached itself to many of the stones and bowlders submerged along the shores. The average density of the water was 1.006.

Six-Mile or Tellers Bay.—The name is due to the original length of this bay, which extends in the same direction as Creel Bay and is of the same general character. Soundings show a maximum depth of 10 feet, shoaling gradually to the muddy and weed-grown northern end. The density on July 23, 1907, was 1.0056.

Mission Bay.—This part of the southeastern portion of the main section of the lake has only a fraction of its original area. It extends south by west for about three-fourths of a mile, with a breadth one-half as great, and nearly surrounded by high, wooded, morainal hills; is landlocked in all directions except the north, where its entrance has a width of 463 feet and an average depth of not over 3 feet, with a channel 5½ feet deep and about 10 feet wide. The total area approximates one-third of a square mile. The deepest water in the bay is 11½ feet, shoaling uniformly in all directions to the shores.

Mud flats, very soft and yielding, with underlying black soil, fringe its southern extremity and sustain tall rushes and cat-tails, at the water's edge two years ago, but now 15 feet or more from the shore-line. All remaining shore, where not lined with rushes or soft yielding mud, has a gravelly beach. A species of waterweed (*Ruppia maritima*) is found growing uniformly throughout the bay. Fresh water from Court or Spring Lake, one-eighth mile distant, seeps through the rushes into the southern end of this bay. The density of the water was found to be 1.0058, the temperature 68° F.

This, perhaps, is the best part of the main section for the introduction of suitable fish, owing to its protection from storms, its narrow entrance easily guarded by a gate, the character of its bottom, the depth, and the seepage of fresh water from the neighboring Court or Spring Lake. A supply of young large-mouthed black bass and catfish were introduced here during the investigation.

EASTERN SECTION.

Devils Lake, south of Lake and Minnewaukan townships, presents the same conditions as appear in the section just described. It is of an irregular shape, its length from the southern extremity of Roque Island to Lamoreau Bridge is approximately 15 miles, and its greatest breadth 3 miles.

In general the bottom is muddy and at a uniform depth of 12 feet. The eastern portion is rapidly shoaling, and it was only with difficulty that the passage could be made with a gasoline launch drawing about 15 inches of water. Soft black mud, bearing a growth of weeds that continually checked the progress of the boat, was found to extend from shore to shore east of the Odessa Township line.

Minnows and sticklebacks (*Pimephales promelas* and *Eucalia inconstans*) constitute the fish life and afford a plenteous supply of food for the great flocks of sea gulls and terns. Many species of ducks are numerous.

Temperature and salinity observations were made at frequent intervals, but no essential variation noted. The surface temperature averaged 70° F., the density 1.009.

LAMOREAU BAY.

This is a beautiful sheet of water extending in a southeasterly direction for 6 miles, with a maximum width of about 2 miles. The shore line does not exhibit the irregularities of other sections. The density of the water was 1.008, the temperature 70° F.

WESTERN SECTION.

This broad section formerly extended from La Rose Ferry, at the eastern end of the United States reservation on Grahams Island, westward to Minnewaukan, 11 miles distant. The area to the west of Grahams Island is now dessicated and covered by a growth of wild grass and weeds, with a narrow channel, not deeper than 3 feet, running northerly to the northwestern extremity of the island toward the old course of the Mauvaise Coulée. The drying up of the straits at Spaldings Ferry and at a point midway between there and the mouth of the coulée forms two small detached bodies of water, the remnant of the tributary arm of this section. Only skiffs or gasoline launches with a draft of 18 inches or less can pass through this portion of Devils Lake. The bottom consists of soft black mud, 2 to 3 feet deep, sustaining a growth of weeds that continually entangled the propeller, forcing frequent halts. The greatest depth found was 7 to 8 feet, the average 3 feet.

The shores along the southern margin of Grahams Island consist of wide mud flats, in many localities over 50 feet in width, but the southern shore presents a narrower stony littoral and a nearer approach to the conditions found in the main section. The average density of water was 1.005 and temperature 74.3° F.

WATERS ADJACENT TO DEVILS LAKE.

To determine the conditions obtaining in neighboring lakes relative to the character of the water, fauna, flora, and other factors important in the study of fish life, brief examinations were made of the following:

Court or Spring Lake.—This is a small sheet of fresh water situated one-eighth mile from Little Mission Bay beyond the roadway and its western bank and inclosed on all sides by wooded hills which protect it from storms that sweep Devils Lake. Its area is approximately one quarter section. No bottom soundings could be made, but a depth of 8 feet and over was found by one of the members of the party swimming about and "sinking." A muddy bottom was found in the center. Small stretches of sandy shore here and there alternate with the rushes and aquatic plants that protect the littoral. Shrubbery and woods approach the water's edge and uncultivated land surrounds this beautiful sheet of water hidden among the hills. The temperature found July 25, 1907, at 11.30 a. m., was 73.5° F., the density being 1.000.

No recession of the water was noted, and there were no evidences of the conditions obtaining in the big lake situated but a few rods away. The lake is fed by bottom springs, its level is 20 feet above

that of Devils Lake, and its fresh water seeps down through the rushes into the southern end of Little Mission Bay.

Many forms of insect life were noted here, aquatic beetles, larvæ, and crustaceans being numerous. Minnows with nuptial tubercles have been identified as the same species inhabiting Devils Lake. Sticklebacks (*Eucalia inconstans*) were also taken, and many tadpoles were observed swimming about.

In general the lake appeared favorable as a breeding pond for black bass, perch, and allied species. With the elevation, the proximity to Mission Bay, the character of the water, and the source of supply, it would not be a difficult task to construct a runway connecting the two bodies of water.

Sweetwater Lake.—This lake, situated 5 miles north of Devils Lake city, in Freshwater and Morris townships, is of irregular shape and its area approximates 11.5 square miles. Sweetwater Inlet, a coulée of considerable size, with branches rising in the northern regions of Ramsey County, enters the lake at its eastern end in Morris Township. From the northeastern end, in Freshwater Township, connection is maintained with Dry Lake by a creek 4 miles in length. The average depth is 7 feet; the maximum, 17 feet. The bottom consists almost wholly of soft mud, sustaining an abundant growth of water milfoil (*Myriophyllum verticillatum*) and pondweed (*Potamogeton pectinatus*), the latter predominating. In many spots the mud is from one-half to 1 foot deep. The shores consist of stretches of rushes, gravel, and a few bowlders, 80 per cent of the littoral being lined with rushes.

As in the case of Devils Lake, this lake is gradually diminishing and breaking up into detached bodies, changes shown by the white alkaline deposit on the lands surrounding the lake, and more strongly by the natural levees and terraces that skirt the shore. The water level is constantly fluctuating, and according to good authority the banks were overflowed during the spring of 1906. In 1889, the "dry year," the lake level dropped until the several passes were frozen dry, but, according to the same authority, not dry enough to kill fish.

Though Sweetwater Lake has thus been shown to possess a number of characters similar to Devils Lake, it is important to emphasize the conditions more favorable to fish life and unlike those obtaining in Devils Lake. From this lake the town of Devils Lake obtains its water supply, the water being soft and good for drinking purposes and steam making. Salinometer tests show it to be perfectly fresh.

Minnows and sticklebacks and aquatic insects, the same species as in Devils Lake, were taken in abundance with seines. Young bass, introduced by the Bureau of Fisheries one month prior to this examination, were captured and found to be in excellent condition.

Dry, Cavanaugh, and the Chain lakes.—About 5 miles to the north of Six-Mile Bay lies Dry Lake, which maintains connection with the Chain Lakes on the northwest and Sweetwater Lake on the east by coulées opening into its upper portion. It extends from north to south for approximately 6 miles, the northern half attaining a breadth of 2 miles, the remainder being 1 mile or less in width. This lake was not visited, but it is reported that a man can easily wade throughout its northern half, while the southern half averages 7 to 8 feet in depth. The lake practically freezes dry in winter. The water is said to be slightly brackish, containing a very small percentage of alkali. There are no fish.

Cavanaugh Lake, a small body of water northwest of Sweetwater Lake, is exceedingly shallow, contains no fish life, is frozen dry in winter, and is considered of but little importance.

The Chain Lakes, consisting of Lake Irvine, Lac Aux Morts, and Twin Lakes, form a series of small-sized, irregular-shaped bodies of water in close proximity and connected by coulées. These lakes are shallow, with muddy bottoms and surrounded by marshes. The level of their water fluctuates under the influence of spring freshets or the evaporation of the summer, and in winter they are frozen dry. Their depth and the character of their shores render them favorable for spawning grounds during the spring and early summer. The water is reported to be fresh with but the slightest presence of alkali.

Wood Lake.—This beautiful sheet of water, located in the interior of the Sioux Indian Reservation about 8 miles from Fort Totten on the south shore of Devils Lake, is of irregular shape with a length of 1 mile and a breadth one-half as great. In general the shores bear rushes that in many localities extend far out into the lake, but there are short stretches of sandy beach favorable for seining. The water, probably derived from springs, is perfectly fresh and suitable for all ordinary uses, and furnishes excellent fishing for yellow perch and pickerel, the former occurring in very great abundance. The small supply of yellow perch and pickerel obtained for the acclimatization experiments conducted at Devils Lake, described in subsequent pages, were seined from this lake. Minnows occur, but not abundantly. Black bass are reported to have been introduced, but none were captured.

PHYSICAL CONDITIONS.

FLUCTUATIONS OF LEVEL.

A study of the fluctuations of the level of Devils Lake is essential to an understanding of conditions relative to the disappearance of food fish in 1889 and possible future efforts at restocking.

Devils Lake lies in a region where there is but little rainfall and the evaporation is greater than the precipitation. This condition is force-

MISSION BAY. LOOKING SOUTHWARD.

SOUTHERN SHORE OF MISSION BAY.

fully shown by a study of the normal precipitation records, compiled by Mr. E. J. Glass, observer, United States Weather Bureau. From these it may be noted that in 1905 the rainfall amounted to but 18.5 inches, and this scanty amount had not been equalled at the close of the present investigations in September, 1907, though May, June, and July are the months of the greatest rainfall.

From July 20 to September 10, 1907, comprising seven weeks, the level of the lake dropped approximately one-half foot. Observations of the fluctuations of level were made from a tide gauge established by the Geological Survey in 1883. At the beginning of the period mentioned the lake-level reading was 12.3, at the close it was 11.85.

At the time of the observations at Devils Lake by the Geological Survey a permanent bench mark was established in the yard of Captain Heerman. This consisted of an iron post 3 inches in diameter, with a copper cap, driven into the ground. On the top of the cap was the inscription "U. S. Geological Survey B. M." and in the center a crosscut, as here represented:

Elevation above
sea
Feet.
Datum.

Beside the bench mark a painted wooden tablet reads: "This bench mark is 1,439.08 feet above the sea and represents height of lake in June, 1883. Zero of gauge 22.90 feet below bench."

Observations made by the Bureau of Fisheries party in August, 1907, disclose the fact that this bench mark was situated 143 feet from the present shore line and the level of the lake was found to be 1,428.6, approximately 10½ feet below that of 1883.

The following quotation from the monograph [a] on the Glacial Lake Agassiz by Warren Upham, pages 594–595, describes the fluctuations in level common to lakes of this region:

Through the past hundred years maximum and minimum stages of the great Laurentian lakes have alternated in cycles of about a dozen years, during which comparatively scanty average rainfall for several years was followed by unusually abundant rainfall. These fluctuations are similar with those just noted in the rainfall of North Dakota. Besides such short cycles important secular changes of the mean annual precipitation in this State, occupying considerably longer periods, have caused remarkable changes in the levels of numerous lakes which have no outlets.

Devils Lake thus shows evidence of having attained, about the year 1830, a level of 16 feet higher than its low stage in 1889, reaching at or near the former date to the line that limits the large and dense timber of its bordering

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[a] U. S. Geological Survey Monograph XXV. The Glacial Lake Agassiz by Warren Upham. Washington, 1895.

groves. Below that line are only smaller and scattered trees, of which Capt. E. E. Heerman informed me that the largest found by him and cut a few years ago had 57 rings of annual growth. Within the twenty-five years since the building of Fort Totten this lake has fallen 9 or 10 feet, and it has fluctuated 4 feet under the influence of the changes in the average annual precipitation of rain and snow during the past dozen years.

The high stage reached by this lake about sixty years ago appears to have been limited by an avenue of discharge eastward into Stump Lake, which rose at the same time to within about 3 feet of this height. The latter and smaller lake, receiving no large tributary and lying in a basin that nowhere extends many miles from the lake, was prevented by evaporation from rising quite so high as Devils Lake, which, during years of abundant rains and snows, receives a large tributary, the Mauvaise Coulée, draining a broad area that stretches 60 miles northwestward to the Turtle Mountain. The outlet from Devils Lake into Stump Lake was nearly due eastward from Jerusalem, situated on Lamoreaux Bay at the most eastern portion of the entire lake shore. With an overflow at this point, Devils Lake may many times have been raised to this beach by periodic variations in rainfall during the many centuries since the ice age.

At the time when the last ice sheet retreated, however, the confluent water of Devils and Stump lakes were raised to a shore line which now has a slight ascent from west to east, lying 21 to 25 feet above the low stage of Devils Lake in 1889. This shore is traceable around both lakes, passing above the watershed that now divides them.

From the same authority are taken the following notes on elevation:

	Feet above the sea.
Devils Lake, surface of water, August 8, 1887	1,431.6
Devils Lake, surface of water, in 1889	1,430
Devils Lake, highest and lowest stages during the years 1880 to 1889	1,434–1,430

From notes of investigations:

Devils Lake, bench mark, U. S. G. S., June, 1883	1,439.08
Devils Lake level by Bureau of Fisheries, August 21, 1907	1,428.6

By these figures it will be observed that Devils Lake rose 5 feet between 1880 and 1883, attaining its highest level, 1,439.08 feet, in the latter year. Since then it has diminished steadily, dropping 9 feet in the succeeding six years and 1½ feet since the "dry year," 1889. The lake at present is at its lowest, and it is doubtful whether any maximum seasonal fluctuation can cause it to attain the level of 1889. It is a matter of common knowledge that bays and tributaries navigated by steamers in 1883 are now entirely desiccated or closed to navigation. At that time the main body of the lake was reported to have a depth of 35 feet. Soundings made in August, 1907, by the Bureau of Fisheries, show a maximum depth of only 25 feet.

In considering these data the apparent significance of plowed land in connection with the drainage and precipitation must not be overlooked. The recent lowering of the lake level has obtained

during a period of rapid development of the surrounding farm lands, which absorb a considerable part of the precipitation. The destruction of spawning beds by the drying of Souris or Mouse River as the result of cultivation of its banks is generally conceded to be one of the principal causes for the disappearance of fish from the waters of Devils Lake.

TEMPERATURE RECORDS.

During the investigations described by this report daily observations were made of the air and water temperatures from July 26 to September 4, 1907. Readings were made at 8 a. m. and 8 p. m. during July, and at 8 a. m. and 7 p. m. during August and September. The results of these observations, briefly tabulated, are:

Dates (inclusive).	Average temperature of air.		Average temperature of water.	
	8 a. m.	*8 p. m.*	*8 a. m.*	*8 p. m.*
July 26–31	64.32	70.0	69.83	72.75
				7 p. m.
August 1–15	62.8	71.0	67.0	68.73
August 16–31	59.37	68.18	63.62	65.28
		7 p. m.		
September 1–5	56.0	68.3	52.66	66.0

Other observations were made at irregular intervals, both in time and locality, during the examination of the lake, especially when running lines of soundings.

From the maximum and minimum thermometers set up at the headquarters of the party the following averages were obtained. Readings were taken daily at 7.30 p. m., and the instruments were placed in a protected position:

Dates (inclusive).	Average daily minimum temperature.	Average daily maximum temperature.
July 25–31	55.5	78.2
August 1–15	52.0	74.43
August 16–31	50.9	75.1

The lowest temperature recorded was 42°, the highest 88°.

The importance of temperature in relation to fish culture and maintenance can not be overestimated. In the Devils Lake region the difference between the mean temperatures of summer and winter is very great, the winters being very cold and the summers, in part, hot. During the months of July and August the mornings and nights are cool, the midday delightful. In winter the temperature is continuously below zero (Fahrenheit), but the dryness of the air makes the extreme cold (0° to —43°) more endurable than the higher temperatures of a more humid region.

Ice commences to form about the middle of November and remains until the middle of April. Mr. E. J. Glass, the observer of the Weather Bureau at Devils Lake, states that the main body of Devils Lake will not freeze solid, 4 feet being considered a good estimate of the thickness of ice formed, which is more or less porous, with big cracks, often 3 feet wide. During the warmer days the ice in expanding closes the cracks and, bending downward, forms V-shaped grooves, or upward, solid walls. The intense dry cold, according to the same observer, will often cause the ice to evaporate without liquifying, and ice walls thus formed have been observed gradually to disappear.

QUALITY OF WATER.

In June, 1906, with a view to ascertaining whether the water of Devils Lake was injurious to fish life, and, if so, to what extent, Messrs. C. M. Fisher and Charles E. Taylor, residents of the community, forwarded to the Bureau of Fisheries for analysis 2 gallons of water from Creel Bay.[a] This specimen was submitted to the Bureau of Chemistry, which furnished the following report:

Analysis 3064 Misc.

	Parts per million.
Calcium	29.66
Magnesium	452.48
Sodium	2,118.50
Chlorine	821.84
Sulphuric acid ion	4,345.84
Carbonic acid ion	119.16
Bicarbonic acid ion	629.82
Total	8,517.3

Hypothetical Combination.

	Parts per million.
Calcium bicarbonate	119.8
Magnesium bicarbonate	647.6
Magnesium carbonate	167.0
Magnesium sulphate	1,470.0
Sodium sulphate	4,758.9
Sodium chloride	1,354.0
Total	8,517.3

The water of Devils Lake possesses many qualities that render it unsuitable for drinking and for engine boilers, etc. It is reported that in former years, before the level of the lake dropped to its present plane, it was quite generally used for drinking, but at present this is not the case, though cattle are said to drink freely of it. The

[a] The analysis given above may be compared with that of 1907, station No. 4, on page 14.

writer found the water to be slightly brackish, though not disagreeable, and when used for cleansing purposes it was satisfactory, though soap will not produce a lather with it.

In order to determine to what extent the water varies in the several representative portions of the lake, samples were obtained from the stations shown upon the chart accompanying this report. Following are the results of the analyses, the specimens being designated by the laboratory numbers of the Bureau of Chemistry:

ANALYSES OF WATERS OF DEVILS LAKE, NORTH DAKOTA, 1907.

[Parts per million.]

Description.	Station 2, off mouth Creel Bay. (4838)	Station 4, off wharf Creel Bay. (4840)	Station 3, Mission Bay. (4839)	Station 5, Large Lake. (4841)	Station 1, Six-mile Bay. (4837)	Station 6, East Lake. (4842)
Carbonic acid ion	107.8	108.1	119.2	125.1	128.7	154.9
Bicarbonic acid ion	495.4	499.9	527.4	538.9	546.5	555.6
Silica	20.8	21.0	23.0	26.6	37.8	44.0
Chlorin	856.8	866.8	876.1	900.3	906.1	1,122.0
Iron	7.1	9.9	11.0	14.8	15.3	16.4
Calcium	18.6	22.9	24.9	26.3	31.0	31.2
Magnesium	493.8	504.3	509.2	530.5	545.5	601.6
Sulphuric acid ion	4,654.0	4,774.6	4,856.9	4,977.9	5,206.0	6,254.4
Sodium	1,987.8	2,030.3	2,075.0	2,108.3	2,193.8	2,725.3
Potassium	186.2	187.8	195.7	199.7	204.7	250.0

HYPOTHETICAL COMBINATION.

[Parts per million.]

Description.	Station 2, off mouth Creel Bay. (4838)	Station 4, off wharf Creel Bay. (4840)	Station 3, Mission Bay. (4839)	Station 5, Large Lake. (4841)	Station 1, Six-mile Bay. (4837)	Station 6, East Lake. (4842)
Potassium chloride	354.8	357.9	372.9	380.5	390.5	476.4
Sodium chloride	1,135.7	1,149.7	1,153.3	1,187.3	1,189.5	1,478.4
Sodium sulphate	4,749.5	4,863.9	4,997.7	5,058.8	5,319.7	6,607.8
Magnesium sulphate	1,810.8	1,865.4	1,855.5	1,955.1	2,020.0	2,243.0
Magnesium carbonate	151.6	152.0	167.6	179.9	181.0	217.8
Magnesium bicarbonate	503.0	498.7	513.2	505.9	508.0	511.4
Calcium bicarbonate	75.2	92.6	100.7	106.3	125.0	126.1
Ferrous bicarbonate	22.6	31.5	35.0	47.1	48.7	52.2
Silica	20.8	26.6	23.0	21.0	37.8	44.0

Considerable variation may be observed in the chemical character of the water in the several portions of the lake.

For a general understanding of the significance of these analyses given above the explanation of the term "alkali" may be useful. An "alkali" is a compound of hydrogen and oxygen with any one of the metals—lithium, sodium, potassium, rubidium, cesium, or the radical ammonium. The alkalis are all soluble in water and are capable of neutralizing acids and turning red litmus blue. Aqueous solutions of the alkalis of moderate strength act corrosively upon animal and vegetable substances. Two main classes may be distin-

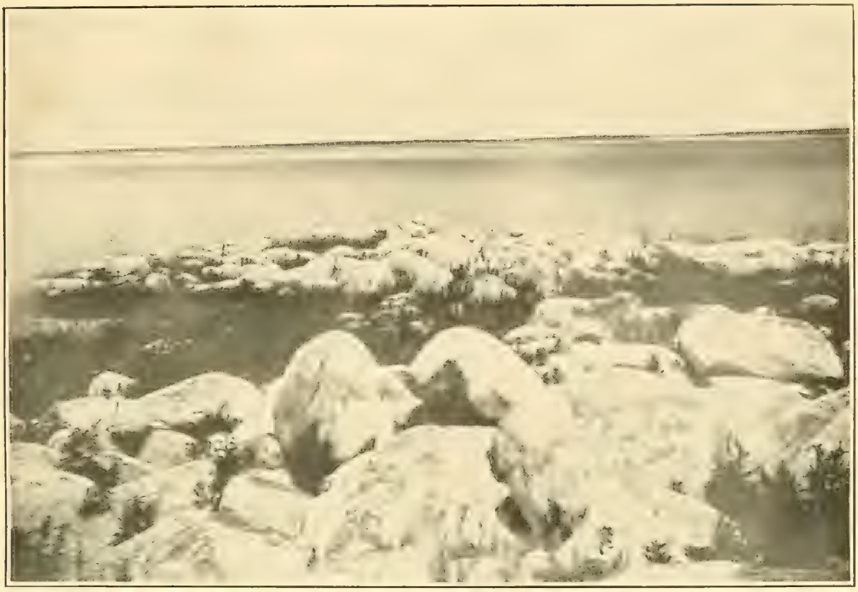
guished in connection with soils: "Black" alkali, in which sodium carbonate predominates, and which is on this account highly corrosive and injurious to vegetation; and "white" alkali, the predominant constituent of which is sodium sulphate, and which is much less harmful to plant growth. Both when present in considerable quantities, by their interference with osmotic action (the process by which seeds and plants take up moisture from the soil), prevent or retard germination and growth. It will be observed that sodium sulphate or "white alkali" is the principal constituent of the water of Devils Lake. Epsom salts (magnesium sulphate) and common salt (sodium chloride) are next in quantity and occur in almost equal proportions.

Though the analyses here given disclose the presence of alkaline salts (not free alkali) in relatively high percentage, it can not be assumed that these contained solids in these proportions are necessarily prohibitive to the acclimatization of certain species of fish. The action of this water on introduced fish can be determined by experiment; whether it is deleterious has not been fully demonstrated.

The pebbles and bowlders strewn along the shores of the lake are, as mentioned in earlier portions of this report, wholly or partly encrusted with a white deposit of alkali. Nearly all of the surrounding lands, especially the "dried-up" bays, show upon their surface a thin grayish-white efflorescence resembling frost. These accumulations, generally found in regions of deficient or irregular rainfall when the soil contains unusually large amounts of soluble salts concentrated in or near the surface, represent the residue from the evaporation of moisture.

In fact, the scanty vegetation of the lake shores furnishes strong evidence of the character of the water. As is well known, alkali lands are commonly either entirely devoid of vegetation, or else produce plants of little or no value to man. Slowly, but surely, exposed portions of the basin of the lake are being reclaimed for agricultural purposes after a thorough drainage for several years. The presence of a small amount of alkaline matter in the surrounding higher lands contributes advantageously to the resultant harvest. The more recently exposed portions of Devils Lake are barren or overgrown with a scant growth of wild grasses possessing a marked tolerance to alkali and serving as an excellent index, therefore, to the nature of the underlying soil.

Specific gravity.—Observations of the density or specific gravity of the water were made throughout the period spent by the party at Devils Lake, the salinometer and salinometer cup adopted by the Bureau of Fisheries being used for the purpose. Fresh water is considered as 1.000 on a scale ranging from 1.000 to 1.031, sea water registering about 1.025.



BOWLDERS INCRUSTED WITH ALKALI, ON SHORE OF DEVILS LAKE.

SANDY BEACHES AT SOUTHWESTERN PORTION OF MAIN LAKE, NEAR "MILE SIGNAL.

The water at Devils Lake was found to vary from 1.0054 to 1.009, according to locality. Detached bodies, like Mission Lake, especially when surrounded by developed lands, were, for obvious reasons, found to possess the higher densities. The lowest, 1.0054, was observed in Mission Bay, and is to be accounted for by the seepage of small quantities of fresh water from Court or Spring Lake. The average density of the main portion of the lake was 1.006.

BIOLOGICAL FEATURES.

The fauna and flora of Devils Lake are found to have an important bearing on the subject of the present investigation, and demand consideration at this point. Collections were made of the life of the lake, both zoological and botanical, including the plankton, and notes were gathered on all facts relating to the cause of the paucity of fish.

But two varieties of fishes were found, a stickleback (*Eucalia inconstans*) and a minnow (*Pimephales promelas*), which were obtained in abundance, both in frequent hauls of the seine and by a crude but effective trap constructed by one of the party. They were taken literally by the hundreds and without use of bait in any way. The sticklebacks were generally large in size and of a uniform black color, though specimens of a lighter color and mottled appearance were numerous. Often many were seen swimming close to the surface, and, possessing but little activity, were easily captured by hand, while they were seen to be caught by the thousands by gulls and terns. A good proportion of the minnows secured bear nuptial tubercles, with brighter dashes of color; the heads and lateral bands were black.

Prior to 1889 Devils Lake teemed with pickerel, probably *Esox lucius*. Observations upon their abundance and size and the cause of their disappearance are reserved for special mention.

The batrachians were represented by two species, the hellbender (*Cryptobranchus alleghaniensis*) and the leopard frog (*Rana pipiens*). Both were abundant, the former constituting the principal food of the cormorants. In this connection it may be stated that on visiting the "Rock Pile," a small rocky island in the main section of the lake, used as a rookery by cormorants and a few white pelicans, the food disgorged by frightened birds was found to be composed entirely of sticklebacks and young hellbenders. One of these food piles contained 18 and 13 of these animals, respectively, the hellbenders all under 3½ inches in length. Fully 100 nests and 500 birds were counted on this island. Leopard frogs were everywhere abundant along the shores. No turtles are known to occur in the lake.

Muskrats are occasionally seen, and bird life was well represented. During the investigations in this region over fifty species of birds were listed. Immense flocks of black-headed or laughing gulls

(*Larus atricilla*) and common terns (*Sterna hirundo*) rear their young on the rocky shores and islands of the lake and feed upon the sticklebacks and minnows. A few great gray sea gulls (*Larus marinus*) were observed associating with the black-headed form. Flocks of black terns (*Hydrocheilidon nigra*) were not uncommon, being generally seen flying over the marshes and weed-grown portions of the lake. Along the shores many forms of sandpipers, killdeer, and allied forms were numerous, feeding on the exposed muddy flats, and snipe were at all times abundant. Hell-divers, loons, and ducks were everywhere to be seen.

The flora of the lake is exceedingly scanty for reasons already indicated. All or nearly all of the shallower waters contained a species of waterweed (*Ruppia maritima*). The shores are practically devoid of vegetation, though wild flowers of the hardier northern varieties flourish profusely on the prairies and pastures sloping downward to the lake.

Both the plankton and tow nets gave fruitful results. Towings made along the shore and off the wharf of the Chautauqua grounds revealed a remarkable supply of microscopic forms. Towings at and below the surface of the water for periods of but one minute yielded three liquid ounces, principally of copepods (*Diaptomus pallidus*). A few small water bugs (*Notonecta* sp.) and amphipods occur. The abundance of life varies, as is to be expected, throughout the lake system, the weed-grown shallow portions of the shores and bays yielding the richest returns. In the more protected waters of the lake the minute life could be seen with the eye, darting among the rank, coarse vegetation, literally by the millions. Vertical hauls were made with the plankton net during the course of the hydrographic work at stations in various portions of the lake, the stations being located by the same methods employed for obtaining water specimens. The results of all hauls proved satisfactory.

The importance of these minute living organisms must be considered carefully in relation to the presence of minnows and sticklebacks. The food of young fish in general includes insects—adults and larvæ—worms, mollusks, crustaceans, smaller fish, fish eggs, and vegetable matter. The part that the plankton crustacea play is important.

DISAPPEARANCE OF PICKEREL.

From all information available it appears that prior to 1889 Devils Lake was well stocked with pickerel. This was, perhaps, an influential factor in the selection of a reservation on its shore by the Sioux Indians, and also in the influx of peoples of Scandinavian origin.

According to excellent authorities, these fish averaged from 5 to 6 pounds, a number of 17 or 18 pounds weight were caught, and one

specimen, displayed in Devils Lake city, weighed 19 pounds. The average length was about 2 feet, the largest measured 3 feet, and those under 7 inches were rarely seen or caught. The flesh was reported to be firm and of fine flavor. No other species of fish was known to have been captured from this lake.

No special attention seems to have been given to the protection of the pickerel and they were caught at all seasons of the year. Lured by artificial minnows weighted and controlled by a cord, the pickerel were speared as they seized the bait. Holes were cut in the ice to continue this practice in winter. It was the most efficient and common method of capture, though the spoon hook and bright-colored cloths were also employed with success.

Though abundant in all portions of the lake, nearly all of the fish were caught in the bays or tributaries of the main lake, and Creel Bay was the principal fishing ground. Devils Lake city was located on the northern shore of that bay and between the town and the "Narrows"—now the northern limit of the bay—the extensive area then existing formed the favorite spawning ground for pickerel. To this point in spring the fish would run through the narrows, where they were speared by thousands. At one time fifty shacks for the fishermen were located in that locality. Where the depth of water was then 6 to 7 feet and the width of the narrows approximately 300 yards, brown, dried-up, barren lands and broad wastes of weeds with incrustations of alkali now cover the famous fishing and spawning grounds.

The abundance of the fish may be deduced from the facts that the United States agent at Fort Totten purchased at one time two carloads of pickerel for shipment; that a butcher of Devils Lake city received also at one time two carloads, and finally the same man held during one season a standing order for 1,200 pounds daily. The fish received were in excellent condition. Pickerel occurred in greatest abundance during the years 1884–1887, and the last ones received were caught by an Indian at Fort Totten in 1889.

Many theories have been advanced to account for their mysterious disappearance, but none is sufficiently supported by the evidence. Destructive fishing methods, the corrosive effect of lake water, desiccation of spawning beds due both to meteorological causes and absorption of precipitation by plowed lands, and even the possibility of underground outlets to the lake have been adduced as explanations.

The following facts, however, merit consideration. The former connection of Devils Lake by the Mauvaise Coulée with the Chain Lakes and ultimately with Dry and Sweetwater lakes has been described in previous pages of this report. During the years 1884 to 1887 Mauvaise Coulée was running throughout the entire year and

in 1888 until the fall. In 1889 it was completely dried up. The water of the coulée was much fresher prior to that time, and pickerel were often observed entering it, headed northward. Mr. Charles E. Taylor reports that in 1888 he "discovered pickerel by the wagon loads dead along the shores and sloughs at the south end of Dry Lake." He affirms that they perished because the lake "froze dry," and Lake Irvine, Lac aux Morts, Dry Lake, and Sweetwater Lake were also reported to have been frozen dry in 1889. It thus appears that the retreat of the migrating fish was completely cut off by the drying up of Mauvaise Coulée. The extent of destruction to fish by the freezing of Sweetwater or the Chain Lakes could not be ascertained. The influx of considerable fresh water to these lakes, and the more favorable conditions offered for spawning purposes were without doubt impelling causes for migration. The loss of extensive spawning areas in Mission and Creel bays, the decimation of their species by overfishing, and the increasing alkalinity of water in Devils Lake contributed to the extensive migration and extermination.

The appearance of pickerel with slimy eyes and scales, as also those bearing sores or injuries, as reported by certain reliable persons, are conditions not infrequently found in fish of advanced age or in spawning individuals. Sufficient evidence could not be gathered to support the theory of any fish disease. All specimens captured during the closing years of their presence were observed to be in healthy condition.

ACCLIMATIZATION EXPERIMENTS.

During the period of the investigations at Devils Lake, observations were made upon several species of food and game fishes introduced and held in control for the purpose of determining respectively their adaptability to the water of the lake. These experiments were of varying character and yielded gratifying results.

Pickerel (*Esox lucius*), suckers (*Catostomus commersonii*), catfish (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), and large-mouth black bass (*Micropterus salmoides*) were experimented with. Attempts to construct fences of galvanized wire cloth and thus pen in the fish under experiment were found impracticable, and live cars of the same material were adopted.

On August 9, 7 suckers and 3 pickerel, all of good size, were confined in a live car measuring 12 by 8 by 6 feet, the frame constructed of 2 by 4 timber, and the sides of 1-inch wire mesh. The fish were seined from the Cheyenne River, at a point 20 miles from the North Dakota Chautauqua grounds. The car was buoyed, resting on the bottom, on the eastern shore of Creel Bay, but a few

rods distant from camp headquarters. The fish when introduced into the car were in excellent condition and manifested no dislike to their environment. On August 12 and 13, when examined, all the fish were in good condition, having withstood a severe storm on the 11th. On August 14 the 3 pickerel and 1 sucker were found dead, with no external or internal injuries to account for the mortality. The remaining suckers were found dead in the car on the 16th, and again no apparent cause for death was observed.

On August 16 a supply of about 300 yellow perch, from 1 to 7 inches long, were obtained from Wood Lake and placed in the live cars. No appreciable mortality occurred among them, the fish were at all times noted to be in excellent condition, and on the departure of the Bureau of Fisheries party September 10 all were healthy and active. Up to October 30 no mortality had been reported, and the perch retained for observation were in good condition.

Through the Bureau of Fisheries on August 27 Mr. C. M. Fisher received a consignment of young black bass and catfish. From this supply a number of both species of fish were retained for observation, and cars of one-fourth inch wire cloth were utilized for their control, the remainder of the fish being released in the lake. With the exception of a small number that were in weakened condition on their arrival, all bass have thrived under the confinement. Fully 95 per cent of the young bass were observed September 10 to be in active, healthful condition. The small number retained for continued observation were reported October 30 to be in excellent condition. Minnows and sticklebacks were provided for food.

A fine large specimen of pickerel, collected September 8 from Wood Lake, was found dead at the bottom of the live car September 10. An examination failed to disclose any injury or diseased organs.

Of the catfish received August 27 a few specimens were retained for control purposes, and these were found to be active September 10.

From the above it may be seen that no deleterious effects of Devils Lake water were to be observed on the yellow perch, black bass, or catfish during the period of confinement, and the same specimens are reported to be at this time in good condition.

SUMMARY AND RECOMMENDATIONS.

The physical and biological features of Devils Lake and its neighboring waters, together with data regarding the disappearance of pickerel and its probable cause, have been presented for a general understanding of the conditions in that region. Experiments on the suitability of a number of species of fish for introduction in the lake have also been described.

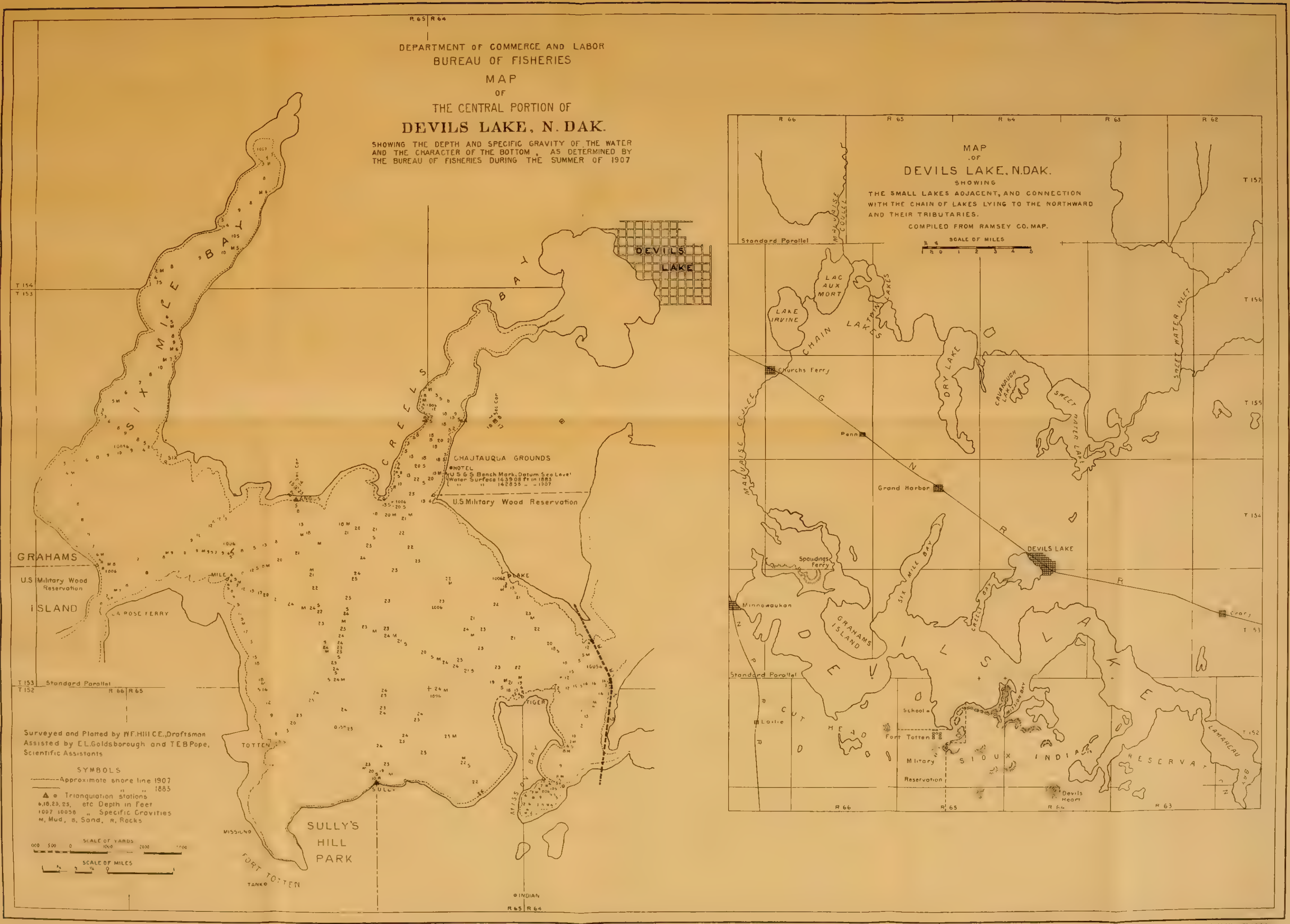
It has been shown that the entire system of Devils Lake waters has been gradually diminishing, owing to deficient precipitation and the development of the surrounding territory. This lowering of the lake level and the consequent desiccation of lake areas has been especially marked since 1883, and at present the lake appears at its lowest known level. Records of former years indicate that the level of the lake fluctuates to a considerable extent and a substantial increase may occur at any future date, but in view of the deficient precipitation disclosed by recent records for this section, the increasing development of surrounding territory, and the history of the lake for the past twenty-five years, it is extremely doubtful whether it will ever regain its former level.

The excessive evaporation has caused the loss of vast spawning and feeding grounds for the pickerel that formerly occurred in the greatest abundance. The disappearance of these fish and the reason for their migration to the shallower northern lakes, where thousands perished, is probably connected with the loss by desiccation of the grounds formerly favorable for their spawning. Exhaustive fishing and the increasing alkalinity of the water were contributory factors.

The stocking of Devils Lake with suitable food or game fishes under the existing conditions is not impracticable. Experiments conducted with yellow perch, black bass, and catfish were highly satisfactory. These species of fish were held in control in sections of the lake exposed to both favorable and unfavorable conditions for a period of two and one-half months and no deleterious effects were observed. It is therefore possible to introduce these or allied species of fish into Devils Lake with expectation of success, but care should be exercised to confine any introduced fish in the more favorable sections of the lake until tangible results of their propagation be manifested. Mission Bay, for example, may be mentioned as favorable. An effective dam and gateway can be constructed at the entrance at a moderate cost, also a culvert or runway leading from Court or Spring Lake to convey fresh water from the higher altitude of that lake. Court or Spring Lake in itself offers a favorable breeding pond for the selected varieties of fish.

Wood Lake is a favorable source of supply for yellow perch, and can be seined without difficulty, especially in its northwestern portion.

O


DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF FISHERIES
MAP
OF
THE CENTRAL PORTION OF
DEVILS LAKE, N. DAK.
SHOWING THE DEPTH AND SPECIFIC GRAVITY OF THE WATER AND THE CHARACTER OF THE BOTTOM, AS DETERMINED BY THE BUREAU OF FISHERIES DURING THE SUMMER OF 1907
SIX MILE BAY
CREELS BAY
DEVILS LAKE
CHAUTAUQUA GROUNDS
HOTEL
U.S.G.S. Bench Mark, Datum Sea Level
U.S. Military Wood Reservation
GRAHAMS ISLAND
U.S. Military Wood Reservation
LA ROSE FERRY
TIGER
MISSION BAY
TOTTEN
SULLY
SULLY'S HILL PARK
FORT TOTTEN
MISSION
TANK
INDIAN
T 154
T 153
T 153 Standard Parallel
T 152
R 66 R 65
R 65 R 64
Surveyed and Plotted by W.F. Hill C.E., Draftsman
Assisted by E.L. Goldsborough and T.E.B. Pope, Scientific Assistants
SYMBOLS
Approximate shore line 1907
" " 1883
Triangulation stations
6, 18, 23, 25, etc. Depth in Feet
1007 10038 " Specific Gravities
M, Mud, S, Sand, R, Rocks
SCALE OF YARDS
SCALE OF MILES
MAP
OF
DEVILS LAKE, N. DAK.
SHOWING
THE SMALL LAKES ADJACENT, AND CONNECTION WITH THE CHAIN OF LAKES LYING TO THE NORTHWARD AND THEIR TRIBUTARIES.
COMPILED FROM RAMSEY CO. MAP.
SCALE OF MILES
R 66
R 65
R 64
R 63
R 62
T 157
T 156
T 155
T 154
T 153
T 152
Standard Parallel
LAC AUX MORT
LAKE IRVINE
CHAIN LAKES
MAUVAISE COULEE
Churchs Ferry
Penn
Grand Harbor
DRY LAKE
CAVANAUGH LAKE
SWEET WATER LAKE
SWEET WATER INLET
DEVILS LAKE
Spauldings Ferry
Minnewaukan
GRAHAMS ISLAND
SIX MILE BAY
CREELS BAY
Crary
DEVILS LAKE
School
Fort Totten
Military Reservation
SIOUX INDIAN RESERVATION
Devils Heart
Lallie
LAMAREAU BAY

AQUATIC PLANTS IN POND CULTURE

By John W. Titcomb
Chief of Division of Fish Culture, Bureau of Fisheries

Bureau of Fisheries Document No. 643

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AQUATIC PLANTS IN POND CULTURE.

By JOHN W. TITCOMB,
Chief of Division of Fish Culture, Bureau of Fisheries.

POND CULTURE AND ITS APPLICATION.

Among the freshwater fishes most desirable for food purposes and for sport-fishing there are certain species, such as the basses, crappies, sunfishes, and catfishes, which are not susceptible to manipulation for the taking and impregnation of their eggs, but must be allowed to mate and select nests, on which the spawn is deposited, fertilized, and hatched in the natural way. For the cultivation of these species, therefore, it is necessary to provide surroundings fulfilling their requirements, and at the same time permitting control of the fish, which purpose is accomplished by the maintenance of natural or artificial ponds. These ponds are stocked with the maximum number of adult fish, and the young hatch in numbers abnormal for the volume of water in which they are contained, there to be reared for a few weeks or months and then distributed to other waters as desired. The pond itself affords sustenance to the young, and therefore the pond is the direct object of attention in order to produce the maximum number of fish. Fish culture under these conditions is consequently intensive pond culture, and in the United States the term "pond culture" distinguishes this branch of fish culture from the propagation of all fishes whose eggs can be expelled and fertilized artificially or which are incubated in hatching houses by the use of special apparatus and equipment. The species to which it is applied are chiefly the black basses, crappies, sunfishes, and catfishes.

The propagation of the Salmonidæ, notably the trouts, approaches pond culture in the fact that several species are often reared in ponds, whereas the other fishes hatched in special equipment are usually distributed as fry as soon as the yolk sac is absorbed. But although the cultivation of the trouts in this country may require ponds in which to rear the young, the different service the ponds perform and the different management required places American trout-rearing

methods outside the proper definition of pond culture.[a] In Europe the case is not wholly similar; although in a few instances American methods have been adopted, the term "pond culture" usually embraces the rearing of trout by much the same methods as are in the United States pursued only with fishes that can not be artificially spawned—that is, the young trout may not be fed artificially, but often subsist in large part upon the natural food supply induced by culture of the ponds.

IMPORTANCE OF AQUATIC PLANTS IN POND CULTURE.

Since the young of the species of fishes to which pond culture is applied in the United States can not be successfully confined in the troughs or small ponds of the American trout breeder, and do not accept artificial food, they must depend for sustenance upon minute forms of animal life found in the waters and upon one another. At a very tender age they develop cannibalistic tendencies, and even where there is apparently an abundance of natural food they may reduce their own numbers 60 to 80 per cent within a month or six weeks from the time of hatching. It is therefore necessary in pond culture to provide not only sufficient natural food to satisfy the physiological requirements of the young fish, but, so far as possible, an abundance which will divert them from the tendency to devour one another.

Through the necessity for natural food, then, comes the primary importance of aquatic plants in pond culture. All animal life is dependent, directly or indirectly, upon plant life, the minute forms as well as many of the larger feeding directly upon plants, and the herbivorous species in turn serving as food for the carnivorous. The young fishes feed upon small crustaceans and other forms which are abundant only in an environment with abundant vegetation. Aquatic plants are therefore the food-producing agency in pond culture, and

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[a] It may not be amiss here to point out the distinction between trout culture by American methods and pond culture proper by reference to the procedure and the conditions at an American trout hatchery.

Trout are not dependent upon natural food, and do not require a natural environment. It is customary to rear them in wooden troughs or in small rectangular ponds of earth, wood, or concrete, through which there is a constant flow of water containing no visible plant or animal life. The water supply may have come directly from a spring or from an artesian well; at many of the most successful commercial trout establishments in the United States the troughs and rearing ponds are supplied with water from artesian wells from 25 feet to 100 feet in depth. As the daily feeding of a large number of fish in a confined area necessitates frequent cleaning, any seeds or spores of vegetation introduced by the water supply have little or no opportunity to obtain a foothold. The trout fry will eat artificial food from the time the yolk sac has been absorbed, and by a judicious arrangements of troughs, tanks, or small ponds the trout raiser can maintain a very large number of fish within a comparatively small compass until they are of satisfactory size for distribution or for market. His dependence is artificial food or the artificial introduction of natural food, and without these means he would be powerless to conduct operations on an extensive scale. In American trout culture aquatic vegetation, so essential in pond culture, is but a negative factor.

are accordingly indispensable. It is also obvious that by a judicious selection of plants the quantity of food can be maintained at the maximum, with corresponding results in the production of young fish.

It is the consensus of opinion among pond culturists that plants are also essential for the proper aeration of the water. At a trout hatchery the fish are supplied with the necessary air by means of a constant flow of water; in pond culture the volume of water supply is often little if any more than enough to compensate for evaporation and leakage, and the oxygenation from this source is limited. The balanced aquarium is a well-recognized illustration of the value of plants as oxygenators. Although there are many factors entering into the aeration of the waters at a pond-culture station that do not apply to the balanced aquarium, and it may be assumed that the larger the body of water the more must other factors than those of the balanced aquarium be considered, there can be no doubt as to the rôle of vegetation in the aeration of shallow ponds of limited area.

It is perhaps superfluous to add that submerged plants bind the bottom soil together, thus acting as a deterrent to turbidity from that source; and that plants doubtless facilitate clarification when the water of a pond has become turbid with surface drainage after a rain or from other external causes of a temporary character. The superintendent of the Tupelo, Mississippi, station, Mr. C. W. Burnham, cites as an evidence of this the numerous reservoirs or "tanks" in the West which are devoid of vegetation and in which the water is constantly roiled. It is possible that in some instances the absence of vegetation is due to the constantly roily water, a condition elsewhere referred to; but control tests in aquaria demonstrate that in an aquarium containing *Cabomba* the water is clarified much more quickly than in one devoid of vegetation. It is believed that if many of the so-called "tanks" of the Western States now devoid of vegetation could be stocked with water plants, these would not only prevent turbid water by binding the bottom soil together, but would under certain conditions prove an aid to clarification.

OBJECTIONABLE ASPECTS OF POND VEGETATION.

Notwithstanding their essential importance in fish ponds, however, and the careful effort requisite to the securing of suitable vegetation, in one aspect all aquatic plants are to the pond culturist wholly a nuisance and a necessary evil. The seining of the ponds, to obtain the young fish for distribution to waters they are intended to stock, or for other purposes, can not be accomplished while thick plant growth is present to entangle the fish and interfere with the operation of the seine, and there is thus a periodical necessity of clear-

ing away or at least reducing all gross vegetation. This process is laborious and expensive; the cost of operating a pond-culture station is in fact largely the cost of this periodic clearance of the ponds, and varies with the characteristics of the predominating species of plants. Methods in practice at several stations will be described in a later portion of this paper.

Particular kinds of vegetation may of course be also objectionable in specific ways other than with reference to the difficulties of removal at seining time. Large-leaved plants may offer too much shade to permit other plants and the requisite animal life to thrive; plants of persistent growth may take possession of the ponds and crowd out species more desirable; or plants not in themselves objectionable may not be desired because other obtainable plants are more desirable for the same qualities. The question becomes one of control. Wherever there is soil bottom, vegetation is voluntary, springing up immediately even in artificial ponds, and any attempt to prevent the entrance by natural agencies of water plants common to a region is fraught with much the same difficulties that are encountered in the attempted exclusion of weeds from a garden. It remains to secure the balance which will bring the conditions nearest to the ideal.

AQUATIC PLANTS AT THE POND CULTURE STATIONS OF THE BUREAU OF FISHERIES.

The government work in pond culture, with its wide geographic range, naturally embraces a variety of conditions and affords interesting and profitable comparisons. The climate, the quality and temperature of the water, the character of the soil, as well as other factors, make the management of each pond-culture station a separate problem. The inevitable dependence upon a natural food supply for the young fish, however, concentrates the efforts in such work about the great factor of vegetation, and makes the selection and control of aquatic plants in ponds the most important question, after water supply, that the pond culturist has to contend with. The popularity of the basses, crappies, and sunfishes, moreover, and the feasibility of increasing their numbers by cultivation, make pond culture a subject of especial interest to people everywhere in the United States, and the Bureau of Fisheries is constantly receiving inquiries and requests for information. The following notes are therefore thought to have interest and value, not only to the professional fish culturist, but to the public generally. They represent efforts to collect specimens of all the aquatic plants found at the various pond-culture stations of the Bureau, with observations of the respective superintendents as to the particular value of the desirable species and

the objectionable characters of the undesirable. It is hoped thus to aid in determining the relative value of each, or at least to afford data which will be useful in future work, at the same time emphasizing the fact that present knowledge of the subject is all too limited. These notes are not based upon biological or other scientific investigation, but are gained from the observations and experience of practical fish culturists. They are moreover presented as pertaining only to the particular field of pond culture conducted by the Bureau. Their application beyond this is yet to be determined.

It may be assumed that all aquatic plants harbor a certain amount of minute animal life. In the following descriptions, therefore, the term "food producer" is applied to plants conspicuous for the large quantity of small animal forms living or breeding thereon. The term "oxygenator" is applied to plants believed to be especially useful in keeping water in a proper condition by throwing off oxygen. The word "shelter" is applied to plants which afford the small fish a hiding place and protection from the large ones. The term "ornamental" is used to designate those plants which extend above the surface and beautify the ponds. The depth of water in which the plants are found as here mentioned applies to the ponds of the respective stations in question. It is recognized that some of the plants thrive in much deeper ponds and lakes.

Common names of the plants are given, but as these are often of restricted local application, the botanical nomenclature also is used, and for more ready identification figures have been inserted for almost every species. All but one of the cuts are copied from Britton and Brown's "Illustrated Flora of North America." The figure of *Chara* is taken from the "Text Book of Botany" by Strasburger, Noll, Schenk, and Schimper. The geographical range of the respective species likewise is taken from these authorities.

For the identification of a large number of these plants the bureau is indebted to Messrs. J. N. Rose and G. H. Shull, of the United States National Herbarium, Smithsonian Institution, and also to the Division of Botany, Department of Agriculture.

COLD SPRINGS, GA.

At this station the water supply is from a large spring and the maximum water temperature is about 82° F. The water contains only a trace of lime, and as a result some difficulty has been experienced in stocking the ponds with aquatic plants, but efforts in this direction have resulted as follows, as reported by the superintendent, Mr. J. J. Stranahan:

For ponds with fairly fertile bottoms with an admixture of muck and clay, the fox-tail (*Myriophyllum spicatum*) excels all other

species. It makes an ideal growth and affords abundant cover for the fish and for the minute life upon which the fish feed, and is apparently a good oxygenator. At the same time it offers but little obstruction to seining operations, owing to its slender feathery growth. Even for ponds having rich muck bottom it has been found most satisfactory, though here considerable work is required to remove it when preparing for seining.

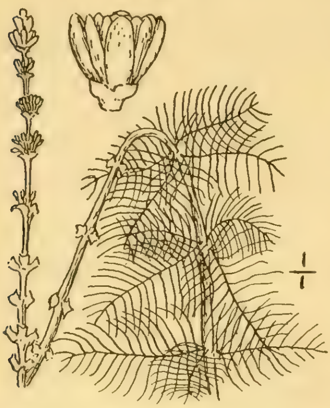

FIG. 1.—Spiked water-milfoil (*Myriophyllum spicatum*). Found in deep water, Newfoundland to Manitoba and the Northwest Territory, south to Florida, Iowa, Utah, and California. (After Britton & Brown.)
Commonly known as fox-tail.

For ponds with sterile bottoms of clay, sand, or gravel, where fox-tail will not thrive, parrot-feather (*Myriophyllum proserpinacoides*) attains an excellent growth and affords abundant lodgment for minute aquatic life and for the alevins; it also provides a sufficient amount of shade for the brood fish and suitable cover for their nesting places. Large-mouth black bass seem to prefer the fibrous roots of these plants to all other nesting materials. Both plants disappear from the warmest parts of the ponds by midsummer and are replanted in the fall or following spring. Near the inflow, especially of ponds which are abundantly supplied with water, the plants thrive throughout the year. The parrot-feather is more susceptible to high temperatures than the fox-tail. These two plants have proved so satisfactory at Cold Springs that the superintendent has seen little occasion to experiment with other species.

FIG. 2.—Chilean water-milfoil (*Myriophyllum proserpinacoides*). (After Britton & Brown.) Native of Chile, introduced in various localities in the United States, where it is known chiefly as "parrot-feather."

FISH LAKES, WASHINGTON, D. C.

Although the Fish Lakes at Washington are no longer maintained, observations upon the characteristics of the plant life are valuable for purposes of comparison. The bottoms of the ponds were of dark fertile soil, the maximum water temperature was about 87° F., and the plant growth was extremely dense. Whether the elimination

of some of this luxuriant growth would have resulted in a decrease in the production of young fish is theoretical. This station had been in operation nearly thirty years, and the lakes contained an unusually large number of plants, upon which Mr. C. K. Green, the last superintendent of the station, makes the following observations:

The hornwort (*Ceratophyllum demersum*) is especially good as a food producer and for shelter, and is fairly good for shade; is a good oxygenator and a good aquarium plant, has little root anchorage, and will grow over hard bottom. It is found in 2 to 4 feet of water, extending to the surface, but not above it. The superintendent considered it the best plant in his ponds.

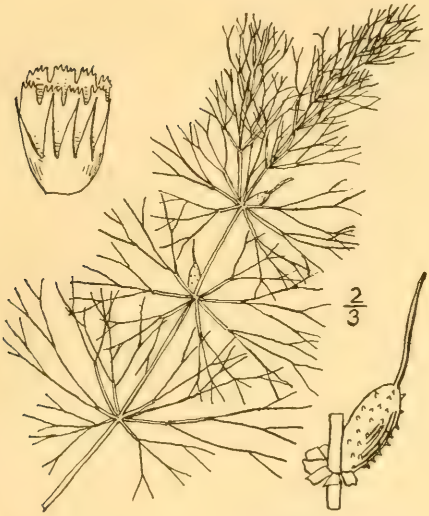

FIG. 3.—Hornwort (*Ceratophyllum demersum*). Found in ponds and slow streams throughout North America, except extreme north. (After Britton & Brown.)

FIG. 4.—Fanwort (*Cabomba caroliniana*). Found in ponds and slow streams, southern Illinois to North Carolina, south to Florida and Texas. (After Britton & Brown.)

Fanwort (*Cabomba caroliniana*) also is especially good as a food producer, for shelter, and for aquarium work, and is given second place. It is regarded as a good oxygenator and fairly good for shade and, like the hornwort, has little root anchorage and will grow on hard bottom. It is found in 1 to 4 feet of water, and extends nearly to the surface.

The curled-leaved pondweed (*Potamogeton crispus*), a good food producer and oxygenator, good for shelter and for shade and ornament, is one of the earliest plants to put forth shoots, and is therefore valuable for early-spawning fishes like the goldfish and carp. It

makes also a good aquarium plant. Found in 2 to 5 feet of water, and reaching to the surface.

FIG. 5.—Curled-leaved pondweed (*Potamogeton crispus*). Found in fresh, brackish, or even salt water, Massachusetts to Pennsylvania and Virginia. Also in Europe. (After Britton & Brown.)

Another *Potamogeton* (*foliosus*), the leafy pondweed, also good as a food producer, oxygenator, and for shelter, is found in 2 to 4 feet of

FIG. 6.—Leafy pondweed (*Potamogeton foliosus*). Niagara Falls to Michigan and California. (After Britton & Brown.)

water, extending to but not above the surface. This plant comes fourth in the estimation of the superintendent.

The wild celery, or eel grass (*Vallisneria spiralis*), is found to be a good oxygenator, and is a desirable plant because of its early growth. It is also good for shade and shelter, and is an excellent aquarium

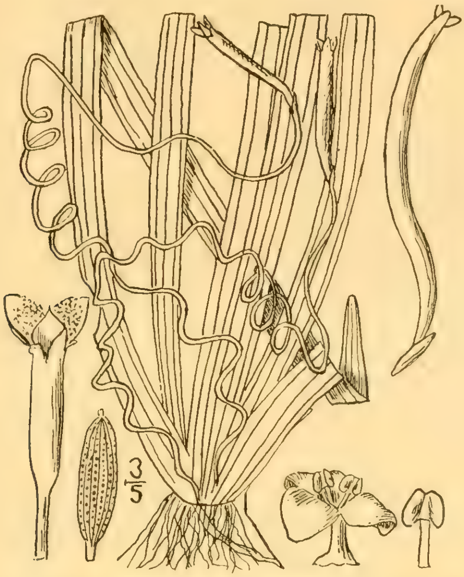

Fig. 7.—Wild celery, or eel-grass (*Vallisneria spiralis*). In quiet waters, New Brunswick to Florida, west to Minnesota, Iowa, and Texas. (After Britton & Brown.)

plant. It is found in 2 to 4 feet of water, extending to but not above the surface.

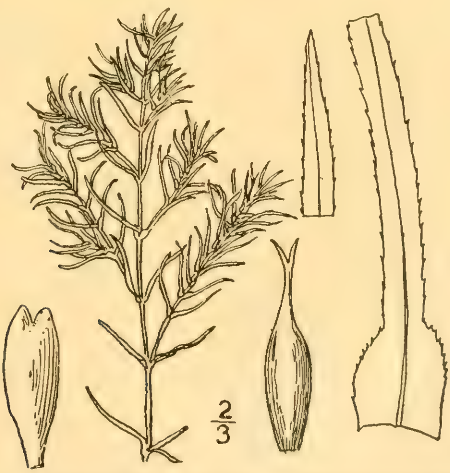

Fig. 8.—Slender Naias (*Naias flexilis*). Found in ponds and streams throughout nearly all North America. (After Britton & Brown.)

The slender Naias (*Naias flexilis*), which is a good food producer, is good for shelter, and is regarded as a fair oxygenator, is somewhat ornamental and a fairly good aquarium plant.

The six plants so far mentioned have been listed in the order of esteem as held by the superintendent of the Fish Lakes. The

FIG. 9.—Waterweed (*Philotria canadensis*). Found nearly throughout North America, except extreme north. (After Britton & Brown.)

FIG. 10.—Water stargrass (*Heteranthera dubia*). Found in still water, Ontario to Oregon, south to Florida and Mexico. Also in Cuba. (After Britton & Brown.)

remainder of the list for this station does not follow any particular order, but, as before, the good or bad qualities the superintendent believed the plants to possess are noted in each case.

FIG. 11.—Needle spike-rush (*Eleocharis acicularis*). Found in wet soil throughout North America, except in extreme north. Also in Europe and Asia. (After Britton & Brown.)

The waterweed (*Philotria canadensis*), which grows in 2 to 4 feet of water, extending to, but not above, the surface, is a good food producer, a good oxygenator, good for shelter, and is valuable for its early growth. It also makes a good aquarium plant. It is dangerous in ponds, however, owing to its dense growth.

Water stargrass (*Heteranthera dubia*) has the same merits as the waterweed, being a good food producer, fair oxygenator, and excellent for the shelter it affords and for its early growth. It is found in water 1 inch to 4 feet deep.

The needle spikerush (*Eleocharis acicularis*) is of very little value except for its early growth. The fine, smooth culms are very easily cleaned by the large-mouth black bass, which cast their spawn upon them.

One of the water-lilies (*Castalia tuberosa*), which furnishes shade and shelter, is ornamental and of value because of its early growth. It serves as a good protection to young fish from predaceous birds.

FIG. 12.—Tuberous white water-lily (*Castalia tuberosa*). Lake Champlain west through Great Lakes to Michigan, south to Trenton, N. J., Meadeville, Pa., and eastern Nebraska. (After Britton & Brown.)

Floating heart (*Limnanthemum nymphæoides*), while but fairly good as a food producer, is excellent for shade, shelter, and ornament and is fairly hardy.

FIG. 13.—Water-lily, or floating heart (*Limnanthemum nymphæoides*). Naturalized in ponds, District of Columbia. Native of Europe and Asia. (After Britton & Brown.)

The fennel-leaved pondweed (*Potamogeton pectinatus*) is somewhat objectionable on account of its excessive growth. It is, however, a good food producer, a fair oxygenator, and fairly good for shelter. Found in 1 to 4 feet of water.

The pickerelweed (*Pontederia cordata*), found in 6 to 12 feet of water, is not especially valuable in fish culture, although it has some merit for ornamental qualities, for shade, and for shelter. It is not thought to be a good oxygenator or food producer.

The two duckweeds, *Spirodela polyrhiza* and the more common *Lemna minor*, are not highly esteemed, though not especially objectionable. The larger form is quite ornamental, and both are of

Fig. 14.—Fennel-leaved pondweed (*Potamogeton pectinatus*). Found in fresh, brackish, or salt water, Cape Breton to British Columbia, south to Florida, Texas, and California. Also in Europe. (After Britton & Brown.)

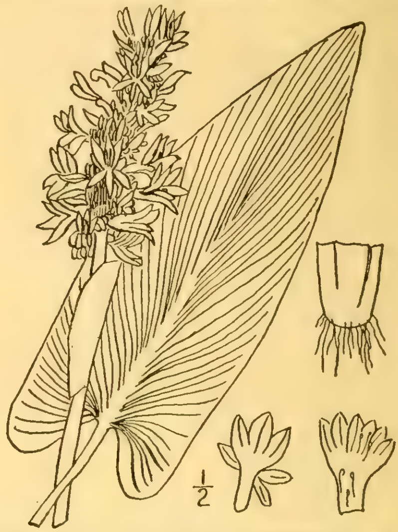

Fig. 15.—Pickerelweed (*Pontederia cordata*). Borders of ponds and streams, Nova Scotia to Minnesota, south to Florida and Texas. (After Britton & Brown.)

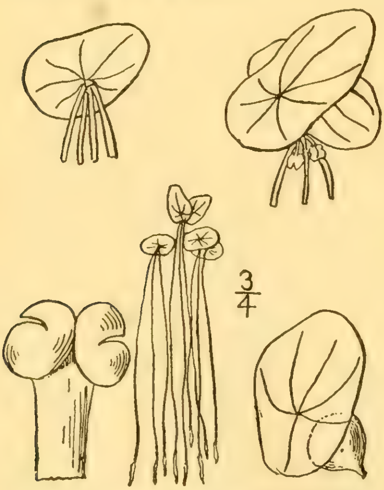

Fig. 16.—Greater duckweed (*Spirodela polyrhiza*). Found in rivers, ponds, pools, and shallow lakes, Nova Scotia to British Columbia, south to South Carolina, Texas, northern Mexico, and Nevada. Widely distributed in the old world and tropical America. (After Britton & Brown.)

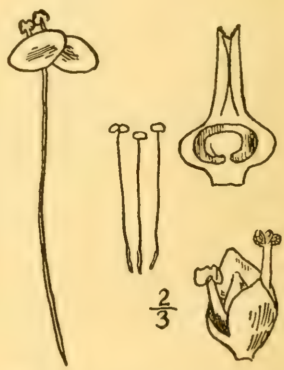

Fig. 17.—Lesser duckweed (*Lemna minor*). Found in ponds, lakes, and stagnant waters throughout North America below 58° N. lat. Also in Europe. (After Britton & Brown.)

early growth. For fish-cultural purposes, however, their poor qualities as food producers and oxygenators make them insignificant.

The water clover (*Marsilea quadrifolia*) is excellent for shade and shelter, is ornamental, and of early growth. It is objectionable in shallow ponds, however, completely covering the surface to a depth of about 2 feet.

At this station the limeweed (*Chara*) is valued as a food producer, harboring the small forms which are especially good as food for young fish, and as an oxygenator it is found remarkable. It is fairly good for shelter and as an aquarium plant.

The spatterdock (*Nymphæa advena*) is valued chiefly as an ornament and for the shade and shelter it affords. It is also of early growth, but it is a poor food producer on account of its long, smooth stems, which do not provide favorable breeding places for insect larvæ or other minute animal life. It is found in 1 to 4 feet of water.

The long-leaved pondweed (*Potamogeton lonchites*) does not rank with the two other Potamogetons mentioned here, being but fairly good in any of the important respects.

FIG. 18.—Water clover (*Marsilea quadrifolia*). Found along the shores of Bantam Lake, Litchfield County, Conn., whence it has been introduced into various parts of the country, notably eastern Massachusetts. Native of Europe and Asia. (After Britton & Brown.)

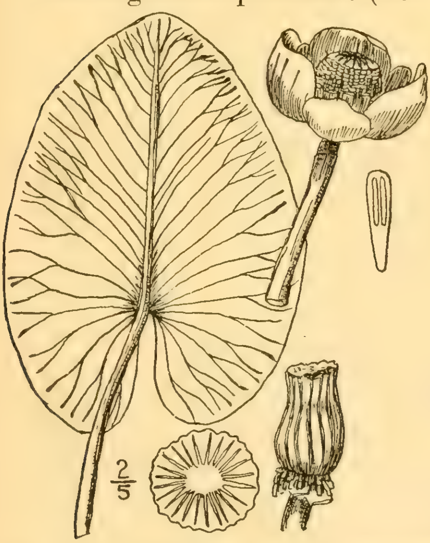

FIG. 19.—Large yellow pond-lily (*Nymphæa advena*). Found in ponds and slow streams, New Brunswick and Nova Scotia to Rocky Mountains, south to Florida, Texas, and Utah. (After Britton & Brown.) Called also spatterdock.

FIG. 20.—Long-leaved pondweed (*Potamogeton lonchites*). Found in ponds and slow streams, New Brunswick to Washington, south to Florida and California. (After Britton & Brown.)

The water chestnut (*Trapa natans*), though fairly good as a food producer and for shelter, shade, and ornament, is of negative value in fish culture.

FIG. 21.—Water chestnut (*Trapa natans*). Naturalized in ponds, eastern Massachusetts and near Schenectady, N. Y. Native of Europe. (After Britton & Brown.)

The lotus (*Nelumbo lutea*) is troublesome to the pond culturist, having bulbs extending 3 feet into the mud and being accordingly difficult to remove when not desired. It is, however, very ornamental, good for shade, and fairly good for shelter.

Had it been possible, Mr. Green states, he would have eradicated from this station the waterweed, the water chestnut, the fennel-leaved pondweed, the duckweeds, and the water clover. In ponds maintained for angling, however, rather than for propagating purposes, these plants should not prove undesirable except in depths of less than 4 feet; though not without due consideration of local conditions should the fennel-leaved pondweed and the water clover be introduced, owing to their dense growth at the surface even in deep water.

FIG. 22.—Lotus (*Nelumbo lutea*). Found locally in Ontario and southward to Florida, west to Michigan, Indian Territory, and Louisiana. (After Britton & Brown.)

WYTHEVILLE, VA.

Here the pond bottoms consist of a rich loam to a depth of 12 inches, and the range in water temperature during the summer months is from 70° to 85° F. The following list of plants gives the opinion of the superintendent, Mr. George A. Seagle, as to their respective qualities and characteristics. The preceding lists have not

included semiaquatic or border plants, but arrowhead (*Sagittaria longirostra*) and water plantain (*Alisma plantago-aquatica*) are given an important place among the plants at this station. A more careful investigation may lead to the conclusion that certain semiaquatic plants are equal in value to some of their exuberant companions of the deeper water.

The curled-leaved pondweed (*Potamogeton crispus*, fig. 5) is considered the most desirable plant at this station. Its roots are on muck bottom in water up to 6 feet deep, and it throws up a slender stalk about 2 inches above the surface, on the tip of which is a small white blossom. The plant grows luxuriantly both in summer and winter, and flourishes in both cold and warm water ponds. It furnishes abundant shade and protection, and is a good breeding place for aquatic insects. It is also easy to control, and can be removed from the ponds without injury to the fish. Its only objectionable character is that where the soil is fertile it grows more luxuriantly than is desirable.

The waterweed (*Philotria canadensis*, fig. 9) exhibits the same characters here as at the Fish Lakes station, but is more highly esteemed, being given second place.

The parrot-feather (*Myriophyllum proserpinacoides*, fig. 2), rooting in muck bottom in water up to 6 feet deep, reaches to the surface and throws up a slender stalk about 2 inches above, with a small white blossom at the tip. Because of its value as a shade for fish and as a breeding place for aquatic life, this plant is ranked third in importance at this station. It is also an excellent plant for aquaria.

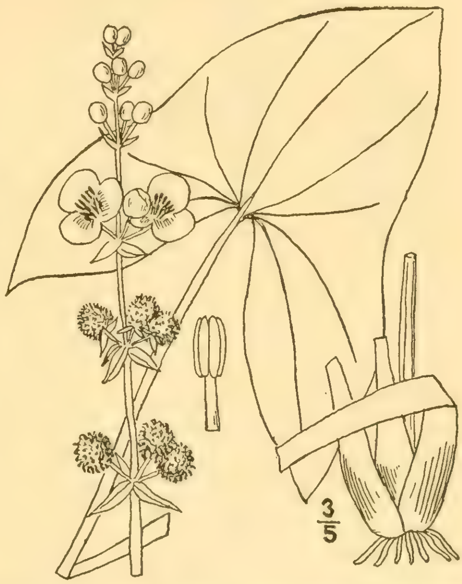

FIG. 23.—Long-beaked arrowhead (*Sagittaria longirostra*). Found in swamps and along ponds, New Jersey and Pennsylvania to Alabama. (After Britton & Brown.)

The arrowhead (*Sagittaria longirostra*) is but semiaquatic, but is a valuable shade and shelter for the young fish. It can also be removed easily and is not difficult to control. It usually roots in soft clay up to 2 feet, and throws up a slender stalk with white blossoms above the surface. The leaves are killed by the first frost, and the plant branches out from the rootstocks in the spring.

The water plantain (*Alisma plantago-aquatica*) is another border plant, being found about the edges of ponds in water only 4 to 6 inches deep, its leaves floating on the surface. It is valuable for the same characters exhibited by the arrowhead.

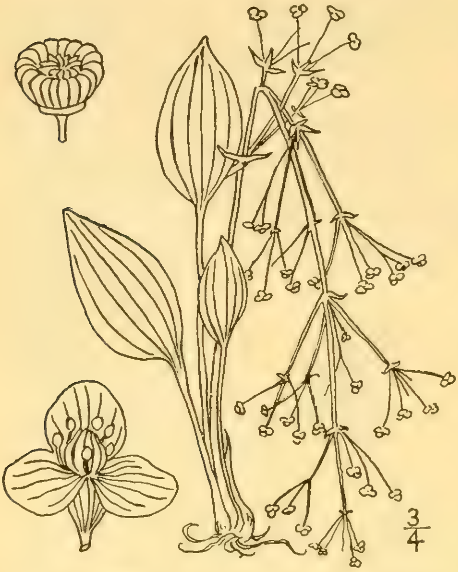

FIG. 24.—Water plantain (*Alisma plantago-aquatica*). Found in shallow water or mud throughout North America. Also in Europe and Asia. (After Britton & Brown.)

The *Chara* at this station is a large form with long, slender internodes, growing in all ponds whether they are fed by spring or creek water. It is an excellent food producer, but grows so densely that the fish can with difficulty get through it, and it is so heavy that it will not float when cut loose from the bottom. When a pond is drawn it settles down like a blanket, entangling the young fish so that it must be picked over by hand in order to extricate them. Its objectionable characters, in fact, are so great that it is only by comparison and on negative grounds that its merits are admitted by the superintendent.


FIG. 25.—*Chara fragilis*. (After Strasburger, Noll, Schenck & Schimper.) A common form of *Chara*.

A number of years ago the ponds at Wytheville were well stocked with curled-leaved pondweed, waterweed, and limeweed, with a few water-lilies (*Castalia odorata*) scattered here and there; but water-lilies have increased from year to year until they have taken complete possession of several of the ponds. At present they are so dense as entirely to exclude the light from the ponds, and in consequence all the submerged plants, including the *Chara*, have been killed, leaving nothing below the lily-pads for the protection of the young fish. During the period when *Chara* was present in great abundance and was regarded as a nuisance and the lily a desirable plant, some of the bass ponds annually yielded an average of about 25,000 young fish

each, but since the lilies have taken the place of all other plants the annual production has dwindled to less than 2,000 fish to a pond. Mr. Seagle is therefore forced to the conclusion that the water-lily is a dangerous plant, especially in ponds having soft fertile bottoms, and that without the submerged plants successful bass culture is impossible. By contrast *Chara*, with its merit of being an excellent food producer, comes into better esteem in spite of its objectionable qualities.

Fig 26.—Sweet-scented white water-lily (*Castalia odorata*). Found in ponds and slow streams, Nova Scotia to Manitoba, south to Florida and Louisiana. (After Britton & Brown.)

NORTHVILLE, MICH.

At the Northville, Mich., station pond culture is a new feature, the ponds having been completed but four years. Vegetation in the form of *Chara* took possession of them almost immediately. A few other plants have obtained a foothold, but not in appreciable quantities. The ponds are devoted to the production of small-mouthed black bass, and the results have been quite successful. The superintendent, Mr. Frank N. Clark, states that he knows of no other plant than *Chara* so productive of fish food of the sort acceptable to the young bass, and the objectionable characters of the plant do not in his opinion offset its merits.

MAMMOTH SPRING, ARK.

At the Mammoth Spring, Ark., station, established in 1905, a portion of the bottoms of three ponds is composed of a heavy muck—the remains of an old swamp bed—and in these portions there immediately sprang up *Chara*, *Elodea*, *Ranunculus aquatilis*, *Ceratophyllum*, *Myriophyllum*, and *Potamogeton*, the relative abundance of each being in about the order named. The entirely new ponds and those parts of the others newly excavated are of a clay and gravel mixture. It appears from the report of the superintendent, Mr. M. F. Staple-

ton, that an attempt was made the first two seasons to establish *Ranunculus aquatilis* and *Elodea* in these latter, but they were crowded out by *Chara*, and *Chara* has since then sprung up voluntarily, with results in all ways satisfactory. The superintendent has no preference for any particular plants. They are now quite generally mixed and all are rank in growth. It is his intention to introduce *Chara* in a proposed new pond, because this plant will flourish on a poorer soil than the other kinds.

At this station, on April 30, 1908, a pond 18,000 feet in area was stocked with 20,000 (actual count) small-mouth black bass fry. On June 24, eight weeks later, there were removed from this pond 6,000 fingerlings, ranging in length from 3 to 4 inches. The rapid growth and large number of fingerlings reared is attributed to the presence of exceptional quantities of small amphipod crustaceans (*Gammarus*), which are a valuable fish food; and the abundance of this food, while attributable to the quality of the water, seems to be dependent also upon the presence and character of the aquatic vegetation.

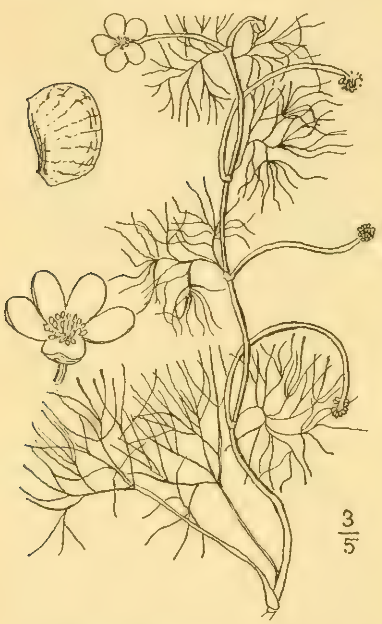

FIG. 27.—White water-crow foot (*Ranunculus aquatilis*). In ponds and streams, Nova Scotia to British Columbia, south to North Carolina and California. Also in Europe and Asia. (After Britton & Brown.)

SAN MARCOS, TEX.

At the San Marcos, Tex., station one of the milfoils, *Myriophyllum heterophyllum*, is preferred to all other water plants. Mr. John L. Leary, the superintendent, states that here some of the water-lilies, *Chara*, and the cattail (*Typha latifolia*) will, if permitted, crowd out all other plants of value, and he regards frogsbit (*Rhizodonium horsfordi*), because of its exuberant growth, as the most objectionable of all the plants found in the pond. He believes water plants essential in pond culture, but suggests that ponds be constructed with sand and gravel bottoms with the view to keeping them free of all aquatic vegetation, except in selected places where the plants are to be walled in with concrete, the walled-in portions to be filled in with earth of the richness required by the plants selected.

At the Mill Creek station of the Michigan Fish Commission for the propagation of both large-mouth and small-mouth black bass *Chara*

is the principal plant, and it is quite satisfactory to the superintendent as a food producer. At one time, he asserts, "The *Potamogeton* drove *Chara* out and I could not raise 100 fish where before the *Chara* went I could raise 1,000."[a]

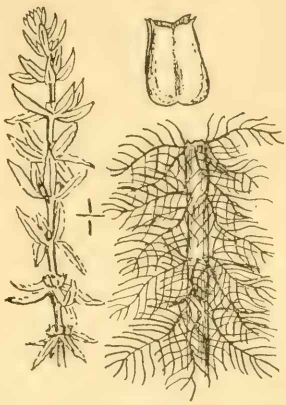

FIG. 28.—Various-leaved water milfoil (*Myriophyllum heterophyllum*). Found in ponds, Ontario and New York to Florida, Texas, and Mexico. (After Britton & Brown.)

RÉSUMÉ OF OBSERVATIONS.

The various estimates of the commoner plants as found at the different stations, together with the differences in condition and environment, make generalization difficult. The foregoing observations seem to show, however, first of all that the fish-cultural value of a species is chiefly a matter of the growth it attains. Its merits, as food producer, shelter, and oxygenator, are determined by the kind and quantity of its foliage, stems, and roots, and so likewise are its demerits, few plants being objectionable in themselves for any reason other than growth which is overabundant or overpersistent.

FIG. 29.—Cattail (*Typha latifolia*). Found in marshes throughout North America, except in extreme north. Also in Europe and Asia. (After Britton & Brown.)

The growth of plants, however, being a matter of environment, depends chiefly, in the case of rooted species, upon the character of the bottom soil. Species most desirable in one locality may be obnoxious in another where by reason of the fertile soil the growth becomes dense and difficult to control. In his paper entitled "The biological relation of aquatic plants to the substratum," Dr. Raymond H. Pond[b] shows by experiment that *Vallisneria spiralis*, *Ranunculus aquatilis tricophyllus*, *Elodea canadensis*, *Myriophyllum spicatum*, *Potamogeton obtusifolius*, and *Potamogeton perfoliatus*, hence probably all rooted aquatics, are for optimum growth dependent upon their rooting in the substratum, and his conclusions are abundantly confirmed by

[a] Dwight Lydell in "Transactions of the American Fisheries Society for 1905," p. 193.
[b] Report U. S. Fish Commission 1903 (1905), p. 483–526.

observations in the ponds here described. His application of the fact to fish culture, however, it would seem might be put differently. While it is true that good soil is to be sought, it should be added that for very rich soil it is important to avoid, if possible, plants with a tendency to rankness.

The quality of the water is a factor which may entirely control the conditions of fish culture. At Cold Springs, Ga., where the water is soft, it is impossible to obtain a permanent growth of vegetation, and the ponds must accordingly be restocked from time to time. Two species of *Myriophyllum* are the only plants that have been successfully maintained through a season. It sometimes happens also that even with exuberant vegetation there is a dearth of animal life, and this might be ascribed to some property or deficiency of the water, just as is the abundance of certain amphipods and other crustaceans which are an important food for young fish, these forms being known to thrive and multiply best in water containing lime.

A further quotation from Doctor Pond, in reference to *Ceratophyllum*, is of interest in this connection. This nonrooted plant he shows to be dependent primarily upon the nutrient salts in solution in the water, and thus a competitor of many of the small forms of life, which derive their sustenance from the same source. A pond filled with *Ceratophyllum* therefore would be expected to contain less of these forms and, consequently, of the forms that live upon them. From this it would seem to follow that the water best suited to *Ceratophyllum* would not contain sufficient food for young fish if that plant were the predominant species, and if this reasoning is correct the value of *Ceratophyllum* would depend upon the presence of sufficient rooted vegetation to offset the effects of competition. Such may have been the conditions at the Fish Lakes, where there were an unusually large number of species of rooted plants, above all of which, however, the superintendent believed *Ceratophyllum* the best.

No particular species of aquatic plant can be said to be always desirable. The endless interrelations of plant and animal life and physical surroundings make the problem a special one for each locality. It should be noted, however, that according to the data here presented great caution should be used as to the introduction of the pondweeds, waterweed, water clover, water-lilies, frogsbit, and cattail. The last two can not be regarded as desirable in any fish pond. *Chara*, indigenous at some stations, is in most cases so much in favor as a food producer that notwithstanding its objectionable characters it is considered the best plant for fish-cultural purposes. It should be borne in mind, however, that at the stations where this plant is a favorite the ponds are of more recent construction than at Wytheville, for instance, where *Chara* is especially troublesome.

The introduction of the water-lily (*Castalia odorata*) into the ponds at Wytheville, with the result of apparently crowding out two other aquatic plants, and the somewhat similar experiences at San Marcos, Tex., and at Mill Creek, Mich., suggest that the partial elimination of one species by the introduction of another may at times be advantageously attempted, and that with a full knowledge of the effects of given combinations of species a desirable balance of vegetation could be maintained by this means. This question also, however, enters the broad field of plant physiology.

METHODS OF CONTROLLING AQUATIC VEGETATION.

ELIMINATION OF UNDESIRABLE PLANTS.

Plants which are in themselves objectionable it is of course desired to eliminate for all time. There is, however, no known method of eradicating the higher forms of vegetation from ponds without destroying the fish, unless it be possible first to draw off the water. When this is done certain forms of plants die from exposure and the roots of others can be grubbed out. Some of the lower forms of vegetation, algal growths frequently described as "frog spittle," "water moss," and "slime," enter into pond culture only as an element of the water supply, and the more obnoxious forms may be destroyed by means of copper sulphate according to the method of Moore and Kellerman for the disinfection of municipal water supplies.[a] This method has been successfully adapted, not only to pond culture but also to waters containing trout, as is set forth in a report of experiments at the White Sulphur Springs station of the Bureau of Fisheries soon to be published.[b] The latter application of the method is of especial interest, for the reason that trout are more than ordinarily susceptible to the toxic properties of copper.

CHECKING SUPERABUNDANT OR UNDESIRED GROWTH.

To prevent superabundance of some vegetation, or to make less objectionable the presence of troublesome species that can not be eradicated, it is sometimes desired to check the growth of the plants. Mr. Kellerman states, in a letter, that in water not unusually hard the waterweed (*Philotria canadensis*), *Chara*, and several species of *Potamogeton* may be considerably checked in growth by treating the water with copper sulphate in the proportion of 8 pounds to 1,000,000 gallons of water. In limestone regions, however, or where the water contains a large amount of organic matter, the proportion of copper

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[a] Moore and Kellerman, Copper as an algicide and disinfectant in water supplies. Bulletin 76, Bureau of Plant Industry, Department of Agriculture. (See p. 12.)

[b] Marsh and Robinson. The treatment of fish-cultural waters with soluble remedial agents, especially copper sulphate as an algicide. Paper presented before the Fourth International Fishery Congress, Washington, September 22, 1908.

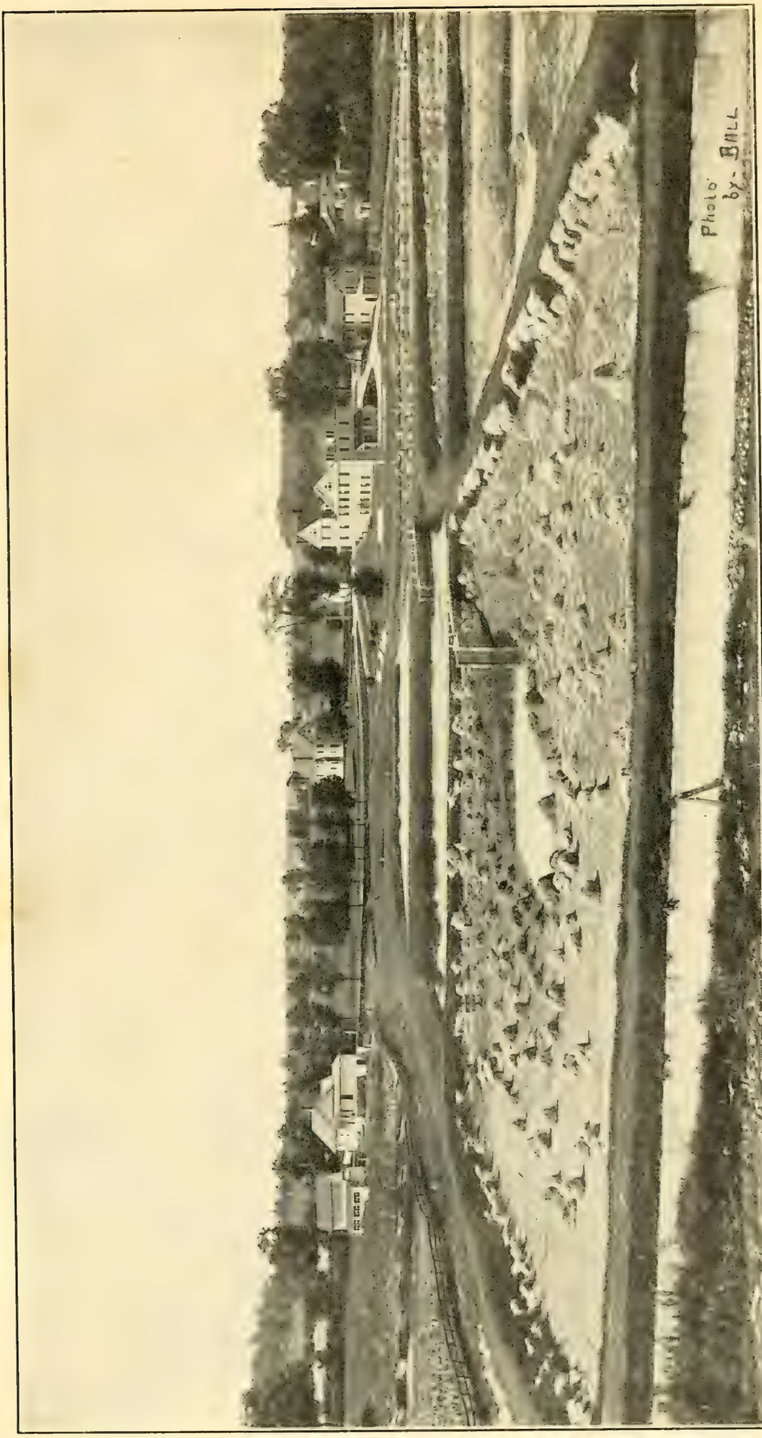
must be increased, and the method is then not applicable to fish culture because a solution of the necessary strength is fatal to most fishes.

It is possible to retard the growth of plants in small ponds by keeping the mud thoroughly stirred up. The result is analogous to natural conditions in streams like the Potomac River during seasons of frequent heavy rains, when the water is almost constantly roily, and in consequence the growth of vegetation is very much less exuberant than in dry seasons, when the water is comparatively clear. In ponds where much mud is carried in and held for a considerable length of time in suspension the growth of both algæ and the higher plants is rendered practically impossible. The same variations in vegetable growth are noticeable where suction dredges have discharged their mud into streams formerly clear. This means—roiling of the waters—has been used with success in small natural ponds maintained for other purposes, but is not known to have been applied to pond culture.

Experience at various pond culture stations shows carp to be quite efficient in checking the growth of vegetation if given access to it early in the spring before it becomes excessive. At the Fish Lakes station several carp were placed in one of the partitions of a bass pond containing *Ceratophyllum demersum*, *Philotria canadensis*, *Potamogeton pectinatus*, *Potamogeton foliosus*, *Vallisneria spiralis*, and *Nymphæa*. When the pond was drawn in the fall, the bottom in this partition was absolutely destitute of any kind of vegetation. The following season carp were not introduced into this pond, and the aquatic growth became as abundant as formerly. Observations at the Erwin station in one of the large ponds where a number of adult carp were confined revealed a great scarcity of aquatic growth, although similar ponds adjoining, which contained bass and other fish, were well supplied. The plants most abundant in this pond were *Philotria canadensis* and *Potamogeton crispus*. The introduction of carp into breeding ponds with other fish is, however, inadvisable for various reasons, of which it is to the present purpose that carp work chiefly on the roots of plants and in mud-bottom ponds keep the water constantly roiled, a condition unfavorable to the breeding of all pond fishes with the possible exception of the crappie. It is very probable, moreover, that the roiliness of the water is itself partly responsible for the retardation of growth credited to the presence of carp.

REMOVAL OF VEGETATION TO PERMIT SEINING.

For the removal of vegetation in ponds preliminary to the periodical seining operations, the pond culturist must depend upon mechanical methods of clearing away the foliage. It is customary to begin taking out the young fish for distribution soon after their yolk sac is absorbed, or after the fry have been feeding but two or three weeks.



PONDS AT NORTHVILLE, MICH., STATION AFTER WATER HAS BEEN DRAWN OFF AND THE CHARA RAKED INTO PILES.

At this season the growth of vegetation is not so exuberant as later in the summer, and the first crop of fish may sometimes be collected by seining around the edges of the ponds without the preliminary clearing away of the vegetation. Often, however, the shallower portions of the ponds must be cleared before even the first crop of fish can be removed. Later the fish will have sought the deeper portions, from which they can not be removed without first drawing off the water. In the latter process the foliage, if left, would settle down as the water diminished, entangling the young fish or smothering them, and it is accordingly necessary to clear away the plants before drawing off the water. The methods of removing the foliage are thus reduced to a mowing process under water, varied and adapted as conditions and circumstances may demand and ingenuity may devise. The methods and apparatus here described have been employed at pond culture stations, but are also applicable to natural ponds where the character of the bottom permits of seining operations.

At the Fish Lakes station the removal of the aquatic foliage was accomplished by mowing with ordinary scythes such as are used in a hay field. The shallower portion of a pond was mowed first, and the water was then partially drawn off so that it did not reach above the armpits of the mowers, its average depth being from 3 to 4 feet. The cut foliage rose to the surface and was carried to the shore in boats.

When it is desired to transfer young fish from the ponds at Northville, Mich., the slash boards are removed from the overflows and the water drawn down. As it recedes from the banks a few feet men rake the *Chara* into piles, taking care that no young fish are destroyed in the operation, and continue this process until all the water and young fish are confined to the kettle of the pond. It was formerly customary to remove the vegetation by the use of teams, but recent experiments show that if left exposed for two weeks the *Chara* settles and finally disappears after the pond has been refilled. The presence of this decaying vegetation ought to stimulate the breeding of more or less insect life for young fish to feed upon.

The method of separating plants and young fish at the Mill Creek station of the Michigan Fish Commission is described by the superintendent, Mr. Dwight Lydell, in substance as follows: A space 10 feet wide around the pond is first cleared of foliage with a common iron-toothed garden rake, a piece of galvanized wire netting of one-fourth-inch mesh being fastened to the back of it to prevent its becoming entangled in the weeds. (Any tinsmith can solder the wire cloth to the iron back.) After this has been done a homemade rake is used to remove the foliage from the deeper water of the pond. The rake is of rude construction, consisting of a cedar pole 8 feet long and 4 or 5 inches in diameter, provided with teeth 6 inches apart and 12 inches

long, made of oak or some similarly strong material. At a proper angle with the teeth are two handles about 20 inches in length inserted as shown in the accompanying illustration. The handles of an old plow can be utilized for the purpose. A crotch line is attached to the ends of the rake, which is operated by three men, one with waders, who stands between the handles and manipulates the implement, and two on the shore to pull it. A fourth man looks over the weeds, sorts out the fish, and pitches the growth upon the bank as it is brought ashore. When not loaded, the rake is easily floated out into the pond. To rake the bottom, the operator sometimes must put his hands and arms under water; and as he wades out with the rake he determines by the density of the moss how far it is necessary to go to secure a rake full. Ordinarily this is about 20 feet beyond the area which was cleaned with the hand raking, but farther if the weeds are not thick. The rake is moved through the weeds slowly to allow the fish to escape, but on reaching the open space made by the garden

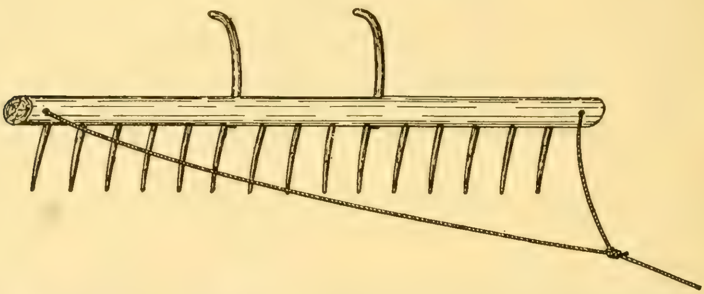


FIG. 30.—Rake devised by Mr. Dwight Lydell, and in use for removing vegetation at the Mill Creek station of the Michigan Fish Commission. For description see text.

rake it can be moved more rapidly, so that as it comes ashore, with water rushing around either end, any fish that may be ahead of it will usually escape into the pond. The few that may become entangled are released by swift handling of the weeds as they are brought ashore. After the first raking is completed a seine is used to remove all fish that may be in the cleared space. Then the rake is used again farther out in the pond, the process being repeated until the pond has been thoroughly cleared of vegetation or the desired number of fish have been obtained.

At the Wytheville station a boat is employed in the removal of the aquatic vegetation from portions of the pond where the growth is most dense. Fastened to each end of the boat is a cleat, through which is a hole about 2 inches in diameter, or of sufficient size to hold a stake loosely fitted in it, the stakes being driven into the bottom of the pond for the purpose of holding the boat steady while the vegetation is being pulled by the rakes. The loosened mass is then

loaded into the boat. After the pond bottom has been gone over in this manner the sluices are opened, and men following the water as the pond is drawn pull by hand the remaining vegetation and stack it in piles. If any patches of *Chara* are found where the fish are liable to lodge, these are reached with rakes and thinned to release the fish. After the fish have been removed, and while the pond bottom is still wet, the piles of *Chara* are removed to the shore with pitchforks. In the removal of such plants as water-lilies, rushes, cattails, etc., the ordinary scythe is used, but this method is resorted to as little as possible because of the tracks made in the bottom of the pond and the muddying of the water.

At the Mammoth Spring station the method of drawing ponds and removing vegetation is somewhat similar to that pursued at Northville. If it is desired to remove fish less than 2 inches in length, all of the vegetation is raked out upon a raft and poled to the bank for subsequent removal by horse and wagon. If larger fingerlings are in the pond, the vegetation is first cleared as thoroughly as possible by a similar method from a space about 100 feet in diameter around the outlet drain. A channel is then cleared from the outlet of the pond to its inlet. Ordinarily this preliminary work requires the services of two men to each pond for two days. The ponds range from three-fourths to $1\frac{1}{4}$ acres in area. On the third day the water is drawn down to the cleared space near the outlet. As it recedes the *Chara* is raked into windrows, the men working in from 1 to 2 feet of water, thus keeping a clear channel ahead of the water line. Windrows are preferred to stacks, because the fish have a means of retreat through the channel formed between the rows.

Four or five men are engaged in the work at pond-drawing time. Perhaps by 3 p. m. of the third day the water will have been drawn down to the " kettle," the 100-foot cleared pool. If the pond contains adult fish, they are at this time removed by sweeping a coarse-meshed seine through the pool. The following morning the water temperature and other conditions are favorable for the removal of the fingerling stock.

The superintendent has tried the Lydell rake, but thinks it involves more labor and that the pond bottom is not so well cleaned as by the method he has adopted. A raft is preferred to a boat, because it will carry a large load of vegetation and the water quickly drains from it. It is homemade, 12 by 16 feet. The outer framework of 2 by 12 inch planks is fastened together by 6-inch bolts and then the inner planks are slipped into place. The raft is supported by six 10-gallon iron-bound kegs wired to the framework. The round holes in the center of each end plank are for the insertion of stakes to hold the raft in place while loading.

The claim of superiority of a raft over the boat ordinarily used for the same purpose seems well founded and leads to the suggestion that a shallow scow of dimensions to suit conditions, with deck and side rails, would also allow the water to drain off as the deck is loaded with vegetation and would be more easily handled. Rapid movement in the comparatively small ponds of the fish culturist not being essential, trucks might be attached to the bottom of the scow for convenience in drawing it ashore or from one pond to another.

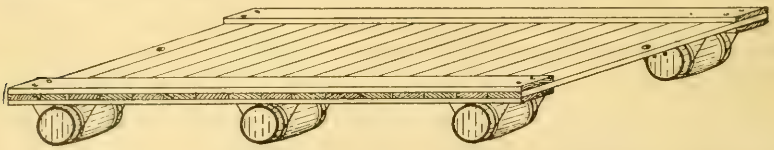


FIG. 31.—Raft in use at Mammoth Spring, Ark., station for carrying the loosened vegetation to shore. For description see text.

At the San Marcos station the removal of aquatic vegetation is accomplished with an ordinary scythe, the men going into the water and cutting the growth as closely as possible. For cutting the heavier vegetation at a distance from the embankments a scythe is sometimes attached to a piece of three-quarter-inch iron piping from 10 to 30 feet in length, the latter being spread at the end to hold the shank of the scythe, which is riveted to it with two small bolts. Hand rakes, especially made from 4-tined hayforks, are then used, care being taken to examine each rakeful of foliage for young fish. An especially made iron rake shown in the accompanying illustration has also

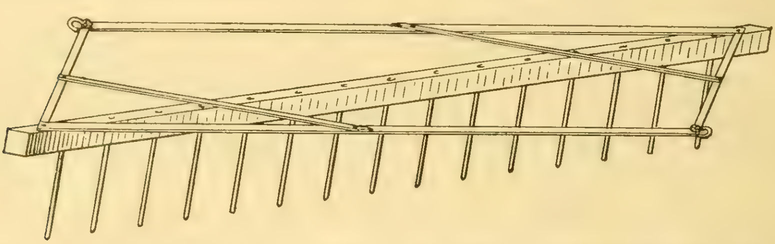
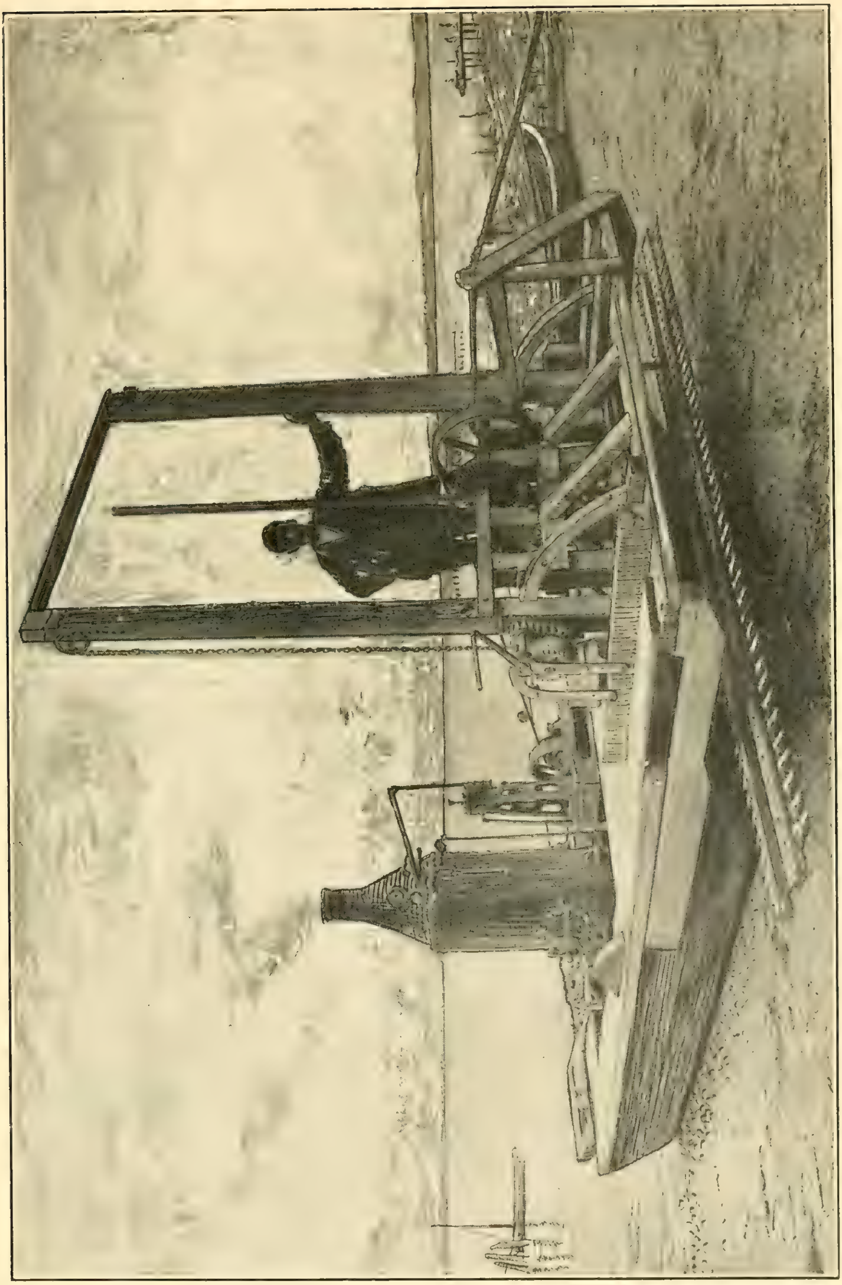


FIG. 32.—Iron rake in use at San Marcos, Tex., station. For description see text.

proved a very effective implement. The main bar, 3 inches in diameter and 8 feet long, is set with 15 teeth 15 inches long, and forms the diagonal of a square frame, at the two remaining corners of which is fixed an iron ring. With a strong rope through each ring, the rake is drawn from one side of the pond to the other, making an 8-foot swath. Two men are usually required on each side of the pond to manipulate the rake.

At the Cold Springs (Ga.) station there is but one pond in which vegetation (*Myriophyllum*) is sufficiently dense to necessitate its removal prior to seining for the young fish. In this pond it grows



MOWING MACHINE DEVISED BY MR. CHARLES T. ALLEN FOR CUTTING EEL-GRASS ON OYSTER GROUNDS.

Some adaptation of this machine could perhaps be used in fish ponds.

exuberantly from bottom to surface and is removed by the use of a wire, about the size of a telegraph wire, loaded with weights and pulled through the pond much as a seine is hauled, except that it is jerked vigorously from side to side. In this way the tender growth of the *Myriophyllum* is easily severed. It is then dragged ashore with a long rake similar to the one in use at San Marcos. The superintendent prefers this method to the use of a scythe.

Owing to the necessity for periodically removing the aquatic foliage at pond-culture stations and the expense involved in the present methods of performing this task, it is obvious that here also is a field for experimentation. In this connection it seems proper to refer to the success of Mr. Charles T. Allen, who some years ago devised an aquatic mowing machine for the purpose of cutting eel grass on oyster grounds.[a] Mr. Allen asserts that the machine will cut 2,400 square feet of grass per minute in water 6 feet deep. Undoubtedly the machine is too large and heavy for use in small ponds, but it might perhaps be modified to suit the requirements of pond culture if the cutting knives can be successfully used on the vegetation of ponds. Gasoline or hand power could be substituted for steam power.

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[a] Report of the United States Commission of Fish and Fisheries for 1892, p. 477–478.

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